POPULAR SCIENCE

JULY 15 CENTS

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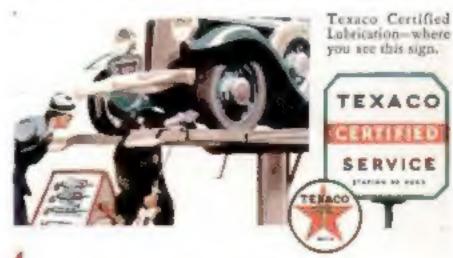
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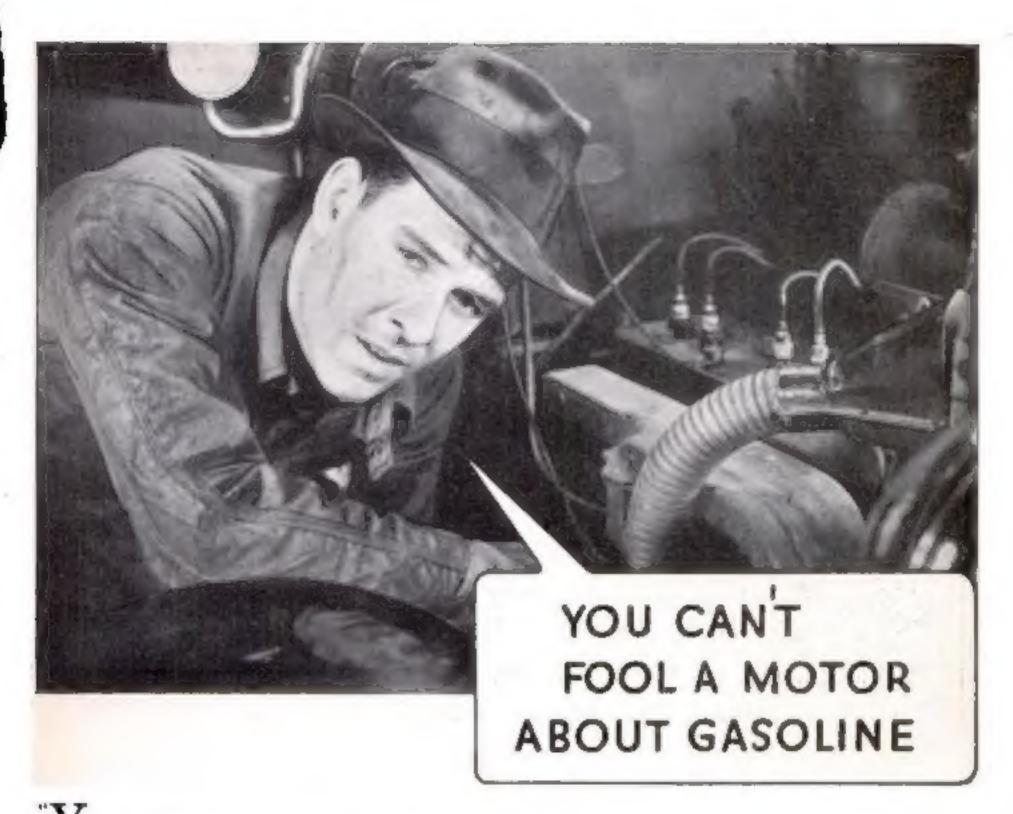
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POPULAR SCIENCE

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In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions



-until I found he paid \$60.50 only

"BOOK-CADILLAC" on the envelope was husband running up a whopping big bill at Detroit's "swankiest" botel. And me at home longing for a new bat.

But when I read his letter, I was terribly gahamed of myself. Jack was having the time of his life-enjoying a room with private bath, circulating lee water -all the famous Book-Cadillac luxury -and it cost only \$2.50 a day. I certainly couldn't crab at that?

Jack said, too, that the food was grand and not at all expensive. "Last night," he wrote, "I ate a delicious full-course dinner for 75c. All four of their restaurants are first rate. Splendid service in

Next time Jack goes to Detroit, I'm going to make him take me with him. It'll be a marvelous vacation, one that we can afford, too.

1200 ROOMS \$2.50 UP

HOTEL

Directed by Ralph Bits J. E. Frawley, Manager

Botel New Yorker, New York City, and Vox Cleve, Dayton Abo under Raigh Bits Direction

HOW TO GET STARTED IN THE HOBBY OF SHIP MODEL MAKING

BUILDING ship models is a hobby that costs very little. Few tools are required, the materials are inexpensive, and in the end you have something really worth while to show for the many hours of pleasant work you have put in. Thousands of Popular Science Monthly readers have found this true in spite of the fact that they had no previous knowledge of ships or of model making when they started to construct their first model from our plans.

Now, however, we have made it still easier to begin this bobby by providing construction kits of carefully selected materials. You no longer have to do a lot of "shopping around" to get what you

Two kits are especially recommended for beginners. One contains all the raw materials (except glue and paints) for building the beautiful model of the Elizabethan galleon Revenge illustrated on pages 66 and 85 of this issue. The kit is further described on page 78. Picturesque as this model is, the construction is not difficult. Do not be deceived by the costly and elaborate appearance of the finished model as it appears in the photographs mentioned. Capt. E. Armitage McCann, who designed it from original historic sources, kept in mind the needs of the beginner at every stage of the construction, and he used all the resources of his many years' experience to simplify the various details, including the rigging, to such a degree that the inexperienced model maker would find the work relatively easy. Each kit is accompanied by four blueprints showing all parts full size. These alone would cost \$1 if purchased separately. The second kit that has been designed

chiefly for beginners contains the sawedout bull and materials (except paints) for a 12 in, long miniature model of the new American liner Manhattan. It is illustrated on page 78. Because it is so very small and simple, the model can be made on the kitchen table-or in the living room, for that matter-with a pocketknife, a safety razor blade, a pair of small-nosed pliers, a file, and, if available, a fret saw or jeweler's saw.

Popular Science Homecraft Guild, 381 Fourth Ave., New York, N. Y.

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(Print very clearly) Note: The Revenue kit is 50 cents higher west of the Mississippi River beause of heavy shipping charges. If desired C. O. D., there will be on extra charge of 25 cents. The Manhaltan kit is not sent C. O. D.

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MOTORISTS WISE SIMONIZ

Our Readers Say

He Gets a Real Kick Out of His Photomicrography

Your article on making photomicrographs guided me in taking several such pictures in my cellar laboratory. Simple Cramer 4 by 5-inch contrast plates were used, giving a one

half second exposure with the microscope condenser in place. The enlargement, when figured for eye observation, was 160 times linear. The differentiation on the finished picture between haematoxylin and cosin was perfect, the red cosin showing, naturally, as black. The nineteen pictures I have



made serve to illustrate a paper on general histology prepared by a medical student. The clides I used were made by a laboratory assistant for rough general work and are so poor that in many cases it was impossible to get a sharp image all over the field. Such prints, however, can be divided and a sharp section selected. I have found much of interest in your recent issues.— J. B. M., Cincinnall, Ohio.

Glue Maker Has Some Real Inside Information

IN ANSWERING C. G. A., Corinne, Utah, I make the following suggestions about give, The increase in volume depends upon the quality of the glue. Good glue should double its weight; had glue will dissolve or become like jelly and cannot be removed whole from the water in which it is soaked. Glue should be soaked in one pound of water to each ownce of give. Soak the glue from tweive to sistern hours and then remove it to the pot without the addition of more water. Cook the glue about three hours at a temperature of ninety degrees F. Be careful that this temperature is not exceeded. If cooked too long it will turn brown and become brittle. To test glue for Its quality, place five ownces of sheet glue in five pounds of water for twelve hours. If the glue is dissolved in this time it is no good. If it is coherent and weighs ten ounces, it is good,-A. R. C., Victoria, B. C.

He Learned About English From the Talking Pictures

Four years ago when I came to America from Germany, I knew practically no English. Instead of going to night school, I went to the

talkies. For four weeks, I went every day, making out the sense of what was said from the action of the play, It taught me more English, as it is actually used in everyday conversation, than a year of schooling would have done. If anyone wants to learn



English as she is spoke in a short time, let him go to the talkies.—A. H., New York Cuy, N.Y.

Nifty Little Experiment With a Rusty Old Nail

In answer to S. B. M.'s letter in a recent issue, I suggest that he try the following experiment: Place a nail in a test tube of boiled water. Place another in a test tube of water as it comes from the faucet. After a time this second nail will rust while the first will not. This rusting, or oxidation, is due to the oxygen of the air that is dissolved in the water and not to the oxygen of the water acts only in the capacity of a catalytic agent,—N. C. T., Dayton, Ohio.

Coldwater Reader Seeks Information on Freezing

In a recent issue of Portlag Science Monticly, there was printed a picture of frost feathers frozen to a post on top of some mountain. Also it was said that an expedition was setting out to study this phenomenon. Frost feathers, I believe, are caused by the freezing of the slight amount of precipitation that takes place directly behind the post, due to moisture-

laden air experiencing a sudden drop in temperature. The sudden drop in temperature is caused by the portial vacuum created disectly behind the post. This slight vacuum is caused by the high-velocity wind blowing past an object that is not streamlined. If a perfectly streamlined



post were erected and kept in line with the wind, no vacuum would be created behind it and no drop in temperature would occur to cause precipitation. Hence, no frost feathers would form. I am guessing, but the temperature of these winds on this mountain must be just about perfect for this to happen. I would guest thirty-two degrees or lower but close to thirty-two, unless the freezing point of water varies as does the boiling point due to water being under different pressures. If that it the case the temperature would be a little higher. That makes a good question for "Our Readers Say." Does water freeze at thirty-two degrees regardless of whether it is subject to a vacuum or a pressure? The boiling point varies. Why shouldn't the freezing point?—C. P. S., Coldwater, N. Y.

Maybe This Reader Has Made a Discovery

For four years I've been reading Potertan Science Monthly without a cheep. Now, that I'm out of my epishell and fully grown, I'm here with a big laugh, having read Big Ship Adds No Weight to Bottom of Canal Lock. I dispute this statement, inasmoch as nothing was said of the ship forcing its weight in water over the sides of the canal. In other words, if the displaced water still remains in the canal, the presence of the hig ship certainly does add weight to the canal lock bot-

tom. How about it, readers? Is my gray matter centered or off? At any rate, Mr. Editor, keep up the good work. (No irony intended.) And when convenient, give me the latest in psychology.—J. L. V., Buckingham, In.

Shoot the Chutes for Life From a Burning Building

I NOTICED an Item in the paper the other day which told of many lives being taved in a

Tokio fire by canvas chutes which were thrown from upper story windows and down which customers slid to safety. Here is an idea that ought to be applied to American shyscrupers. Fire ladders can reach only so high and a person can jump into a fire net only from the lower stories



of a big building. Why not have all upper stories of a skyscraper equipped with these canvas chutes which in an emergency can be thrown to buildings across the street and secured several stories down? Then people, trapped in the burning structure, could slide down the canvas strips to the other buildings and escape.—A. R., Newark, N. J.

Your Ferris Wheel Bug Must Be Getting Dizzy

Ix axswer to J. W., Brinkley, Ark., let me state that there are two velocities represented by the Ferris wheel. One is called angular velocity and is measured in revolutions per unit of time. The other is linear velocity and is measured in feet, yards, or miles per unit of time. If he is computing velocities according to the first method, their speeds are identical, but if he uses the second method, the difference in speed will depend on the Ferris wheel's radius.—R. H. S., Bethany, W. Va.

But Who Can Tell Us Where Niagara Started?

HERE is one for the wise boys: What fools we are to swallow everything that comes along. For instance, if the earth were as old as some of our wise men claim, there would now be no Ningara Falls. Long ago, it would have eaten its way back to Lake Erie. It is now retreating at more than a foot a year, but

at that rate it would retreat, in a million years, over 189 miles. And where would it be then? Here's another: The south polar continent, in so long a time, would have become top-heavy with ice and its weight would turn the earth upside down. Also, the earth is young by



comparison with other planets. If evolution is active on them why has it not gone so far

there that more advanced forms of life might have been carried to our earth?-J. W. C., David City, Nebr.

Earthquake as War Weapon Is a Brand-New Idea

ARE we overlooking a possible war terror of the future? I'm thinking of synthetic earthquakes that might be employed to wreck

whole cities. Suppose a thousand tons of high explosive were planted as a mine and touched off. That's not at all inconceivable; a quarry blast one fifth as large was set off in Michigan a year ago. It jarred acismographs in twenty states. Now suppose a way could



be found to focus the earthquake waves toward a definite objective, instead of allowing them to spread indiscriminately in all directions; say, by the use of a deep-sunk con-crete reflector of parabolic shape, or some other mechanically simple device. What would happen to a city at which the earthquake wave was aimed? I think the recent carthquake catastrophe in California gives its a good idea of the answer .- P. C. G.,

Portland, Ore.

Will Anything Dissolve Hot Water Sediment?

COULD one of your wise readers kindly tell me what can be used to dissolve the sediment left after hard water has been boiled? Or in there anything that will dissolve it? I think you have a wonderful magazine and as far as improvements are concerned I think there is practically nothing you can do to improve it.—L. D. J., Rivermines, Mo.

Raising Tropical Fish Described in June Issue

I'm interestro la aquariums, as are several of my friends, and we have formed an association in this city and would be more than grateful if a corner of the magazine could be devoted to the building of aquariums, tropical toy fish, their habits, feeding, etc. I know that America is a likely place to get information on this subject as it seems a popular hobby over there. However I leave it to the popularity of Our Readers Say columns to decide whether or no we are to have a corner in the magazine for this interesting hobby. We have to pay two shillings a copy for our Popular Screece Montitur and would pay three times that amount .- F. W. G., Pretoria, South Africa,

Not a Pipe Dream But There's Smoke in It

THE fact that smokes rise is something you will grant as correct. If you can show that smoke will go down tostead of up, peo-ple will admit you

have done something remarkable. All you need to accomplish this is the cellophane wrapping that comes around a cigar. Take this little tube, hold it upright, and set fire to the top of it. As a result, you will see the smoke going down the tube instead



of rising. As the flame burns downward more smoke will form and sink below the dame. Why is this?-M. K., Cleveland, Ohio.

This Fresh-Water Diver Made His Own Helmet

I saw in a recent issue that you wanted a letter from someone who had used a shallow-water diving belmet. I made such a belmet two years ago and am still using it. I live on the Black Warrior River and have raised motorboats and other valuable things from the water at a depth of thirty-five feet. In the current of the river, we drop an anthat and hold to the rope. If the rope is turned loose, the diver is washed away from his helmet. The only disadvantage in diving is the inability to take much health-giving exercise.--H. C., Tuscalousa, Ala.

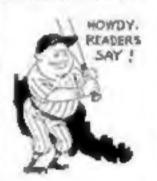
What! More Aviation?

Willy not have more aviation? After all, isn't aviation a science? It is the most promising industry there is. Let's hear more about famous men like Hawks, Byrd. Doolittle, and Stainforth.-W. R., Scarsdale, N. Y.

Is this Merely a Slam at The Heroic Babe Ruth?

RECENTLY a thousand people answered a questionnaire on the worth of prominent men. According to 140 of them, Babe Ruth is the only man in the world worth an \$80,000-a-year salary. Only the President of the United States, said 185, should get that amount and 572, more than half, declared that no-

body was worth that much money. What about the acientists? Nobody mentioned them. How much a year was Edison worth to the world? Or Marconl, or Lister, or Bell or Pasteur? Nabody knows. My guess is that if they had been paid a million dollars a year during the time they



were giving us the electric light, the telephone, the radio, untiseptics, and antitoxins, they would not have received a penny too

much !-- J. D. T., Baltimore, Md.

Here's a Gigantic "If"

Cours some physicist please answer me this one? If it were possible to make a container of some substance that would neither expand nor break, and fill it with water, could the water be frozen?-M. S., Neoga, Ill.

What Next? This Man Wants Us To Start An Art School

HERE's a humble wish of my own which you may disregard without offending me very much, I should like to see an article dealing with the fundamental elements of perspective drawing. Or doesn't it come under the head of science? I should like to learn to make freehand drawings of buildings, etc., without going into an elaborate system of projections and traces. The simpler the method, the better it would suit me.-G. A. K., Ironwood, Mich.

We Have Printed "A, B, C" Articles on Both Subjects

I ACREE with J. A. McA., of Covington, Va. I like the radio stuff, but no magazine or textbook bandles the subject in simple enough terms for some of us dumbbells to sabe. When they try, they quit the simplicity part right at the wrong time. A few short sentences in each issue, running in eerial form, and starting out with the A, B, C of the principles would make your magazine a blesaver for a lot of us. A similar series on photography, starting from the simplest things about it and continued for a good long time, giving plenty of examples, would be of still more help to a good many of us. -A. L. S., Helper, Utah.

Hind-Leg-First Mosquitos Prove Unwelcome Guests

WHAT America really needs right now is a window screen through which mosquitos cannot crawl as they do through the screens

now in use. I have seen a dozen or more of the pesta getting in during the night, in spite of a sixteen-inch mesh. Reliable investigators have told me that the blood-thirtsy creatures crawt in with the hind legs first. While some one is devising a satisfactory screen, he might



at the same time compound a putty with which to mend chipped enamel dishes, It should be able to withstand heat and cold. If it is made white, it must remain so .--

S. G., Lincoln Park, Mich.

Knockers Have Their Place In the Scheme of Things

Don't pay may heed to these no-called knockers who write in to Our Readers Say column. They don't know when they are well off. I find every article of interest to me, and those who do not like this or that, must indeed be very narrow-minded, or else their desire to learn is so very limited that they do not understand that which they do not like. My only objection in that there is not enough of anything. I would suggest, if asked, that you double the thickness of the magazine, with similar facts of interest and, if necessary, double the price. I for one would be more than glad to pay the difference as there is not enough to last between issues .- K. D. R., Elizabeth, N. J.

His Scientific Interest Invades Electric Chair

THERE is one thing I should like to ask of you: Will you please publish an article, with pictures, about the far-famed electric chair. I'm sure if more criminals knew exactly how it works, they would be a little more timid about killing folks. On these grounds, the authorities ought to be very grateful to you. I am sure many other readers will back me up in wanting to see pictures of these chairs, but not from the murderer's point of view .- J. G. C., Toronto, Can.

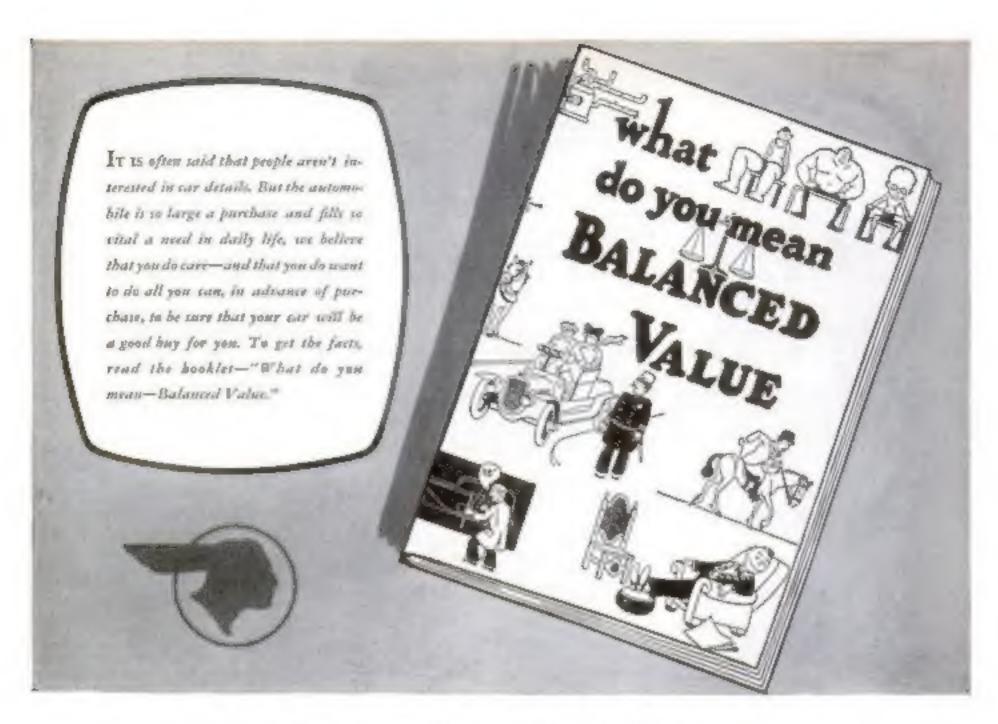
Water Freezes, Ice Floats, And They Weigh the Same

Hear is a cruzy problem that's been bothering me for a long time and I'm turning to your readers for an answer. We all know

that lee dosts in water with some of its surface exposed. Yet, if we pour a pound of water into a pail and let it freeze we will get a pound of ice. But here's the catch: if a pound of water freezes to form a pound of ice, how does it happen that ice floats in water?



Something is floory with my reasoning or else the laws of physics are wrong-and I'm a great believer in the everlasting laws of nature .- L. W. B., Kingston, Wis.



Here is a booklet you ought to read (it is free)

Perhaps the sincerest wish of a man is that his new car will be durable and dependable. He hopes that the thrill he got when he bought it will turn into lasting satisfaction. Which is simply another way of saying that he hopes it will be economical.

In the past, he feels, he has sometimes been lucky sometimes unlucky.

What can be do to be sure, in advance, that his car will stay new long enough to be a good buy for him? He knows be can get out of the car only what has been built into it. So he wants to know what is in itwhat his expectations may be.

Now it is reasonable, isn't it, to say that because Pontiac is the car of Balanced Design it gives the owner Balanced Value? The latter is really the necessary result of the former.

What this means and what it does for the owner are explained in the booklet—"What do you mean—Balanced Value." It is worth reading, we believe, because it will make you a better car buyer—a better judge of value.

PONTLAC \$585 AND UP PONTINE THE ECONOMY STRAIGHT EIGHT A GENERAL MOTORT VALUE

Pontiac, Room 15-266, General Motors Bldg., Detroit, Mich.

Please send me a free copy of "What do you meen—Balanced Value."

NAME.

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How to Get the Booklet

Ask any Pontiac dealer and he will gladly give you a copy. Or, if you prefer, use the coupon, or send a postcard, and we will mail you a copy. The book is Free.



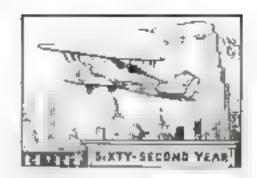
POPULAR SCIENCE

MONTHLY

July 1933

Vol. 123, No. I

RAYMOND J. BROWN, Editor



world's first Steam-Driven Airplane

Successful Flights with Long-Sought Craft Crown Many Similar Attempts by Early Aviation Engineers

VER the Oakland, Calif., Airport, a few days ago a silent plane stanted across the sky trailing a thin ubbon of white vapor. Speciators heard the pilot shout a greeting from the air. They saw him finsh past, akimming the ground at a bundred miles on hour. They watched him bank into a turn, slide to a landing, and, with the propeller spinning backward, toll to a stop in less than a hundred feet. They had seen, for the first time in history, a man fly on wings powered by steam?

first time in history, a man fly on wings powered by steam?

Two brothers, George and Wuham Besler, the former a geologist thirty-one years old, and the latter a mechanical engineer, two years younger, have achieved the dream of





George Besier, felt, with his brother William, inventors of the first successful mean engine for planes, are shown with their plane in which position of special boiler is seen



Drawing shows the arrangement of the V-type engine in the none of the Besler plant. All parts of power plant are shead of the cockpit. At top, steam-driven plans in first fight, with W. Hiam Besler at controls.

Maxim, Langley, and other pioneers of dight. Through their work, the steam-driven airplane, long talked about, long planned, has become a reality

This spectacular development in the field of aeronautics is the result of three years of secret experiment. The inventors began their work in 1930, in a machine shop at Emeryville, Calif. A few weeks ago, they brought the product of their researches, a 180-pound engine developing 150 horsepower, to the Oakland A, rport and installed it at the nose of a conventional Travel Air biplane.

This blue machine, with William Besler at the controls, sped down the runway and climbed into the sir without a sound except the low white of the propeder and the hum of wind through the wires. Swing-

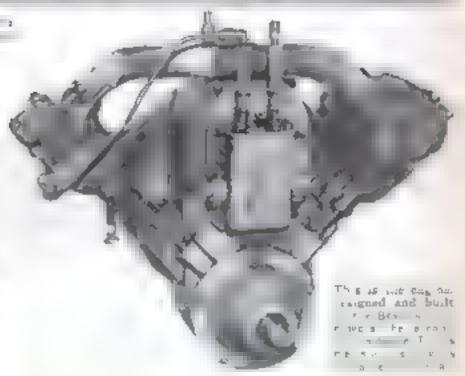


ing back over the field at 200 feet, the prior shouted Hand heard the answering calls from spectators below Conver-

ion in the craft the two invertors is done when I interview

taking off, landing, circling as a removed to the circling as a removed to

Them have and a second to the transfer of the second to th



saults in a ground crash. Coming in at fifty miles an hour the Beslers told me, the new steam plane can sit down and come to a stop in a field hardly a hundred feet square

The engine is a two-cylinder, compound, double-arting, V-type power plant. Its high-pressure cylinder has a three-mich bore and a three-inch stroke; its low-pressure cylinder has five and a quarter-inch bore and a three-inch stroke

Just behind the engine, the inventors showed me the terreshaped metal boiler which, with its super-efficient burner, explains why they have succeeded where others have failed in

attempting to drive planes with a steam engine

Using vaporized fuel oil, the patented burner releases as much as 3,000,000 British thermal units per cubic foot of fire box space. This, they told me, is far in excess of anything hitherto attained. An electric blower drives this tremendous heat down among the flat spirals of a single 500-foot pipe coiled within the botter. Three-eighths of an inch thick, myde measurement, at the bottom, the pipe gradually increases in size until it has an inside diameter of five-eighths of an inch at the top. The water supply to the coiled pipe is thermostatically controlled to keep the temperature constant regardless of pressure

UNDER the fuselage nose is the condense with look like an ordinary radiator for a water-cooled motor and which is said to recover more than ninety percent of the water from the used steam. By using a steam-feed water-pump, the inventors employ the exhaust vapor to pre-heat the feed entering the holler and thus decrease the time requires

huld up pressure within the coils.

The operation of the power plant, once it is started, is practically automatic. At the start of a flight, Witham Besler climbs and the cockpit and flips over a small switch. Instantly the electric blower goes into action, driving air mixed with oil apray through the burner. Here, an electric spark ignites the mixture and sends a blowtorch of flame routing downward around the cotls of pipe. A few minutes later, ateam pressure is high enough for the take-off All the pilot has to do, from then on, is to operate the throttle and reverse lever

At 800 degrees F., the steam pressure built up within the coils reaches 3,500 pounds. With a 1,200-pound pressure, the engine will deliver 150 horsepower, whiching the propelier at 1,675 revolutions a minute. Tests have shown that ten gallons of water is sufficient for a flight of



Here in Welliam Sector proparing to we want in an ex-

door miles. By increasing the size services of the condenser the expert service old me, they be leve they can make this import of water last must rately

As news of their sensational flights thasbed to all parts of the country eager interest was aroused among acromatica authorities. The prospect of steam pianes on the skyways opens up fascingling pos-

Burning fuel on so non-explosive that it merely smolders if struck by the flame of a blowtorch, the new power plant elim-

enough fuel oil for a hundred-mile trip can be bought for forty cents.

Because, above a thousand feet, steam-driven planes would be as silent as soaring birds, they would have particular value in military work. Noiseless war planes have long been sought. But muffling gasoline engines reduces their power to such an extent that the plan is impractical. The new power plant, silent by nature, would permit long-distance raids above the clouds by ghost ships giving off no telltale drone of motors to warn the enemy or to aid in directing anti-aircraft fire.

MOST spectocular of all are the possibilities of steam on the airways of the stratosphere. In the thin atmosphere of this region, ten index or more above the surface of the earth, experts agree, the highspeed transport ships of the future will fly. Here there are no clouds, no storms, and the steady trade winds of the upper blue will increase the speed of long distance passenger, mail, and freight machines.

Already, here and abroad, stratosphere ships, with pressure cabina and variable-pitch propellers, have been designed and are under construction. Test hops have been made in such high-flying experimental craft in France and Germany. The chief stumbling block at present is the gasoline motor. It steadily loses power as it ascends. Climb to 20,000 feet and a motor that delivers 150 horsepower at sea level will retain only half its power. Spiral on up to 30,000 feet and your engine will have but three-tenths of its sea-level horespower. And you are then only half way to the stratosphere! (Continued on page 92)



This picture was made when for the first time in the world's history a steam-driven plane successfully flew with a man at the controls

BOY RIDES TOY SEAPLANE POWERED BY GASOLINE MOTOR



Drive everything but fiv it model seaplane provides aquatic sport for the young son of a british craftsman, who made the machine in his own workshop. The craft skims across the water on its pontoons at a speed of about twelve miles an bour under the power of a midget gasoline motor and an air propeller. When it is ready to be taken home the wings, too small actually to lift it from the water, fold up and the machine is set on a convenient trader to be towed away behind a car

FIFTH WHEEL MAKES TIRE TESTS SAFE



SEEKING a blowout proof racing tire, a manufacturer recently staged high-speed road trials on the Indianapolis Speedway, Samples of tires to be lested were placed, one after another on the right rear wheel of a racing car—usually the first to show wear on this course because of its counter-clockwise turns. Drivers kept the car running until each test tire faned. To protect the driver a life a fifth wheel was added as shown at left. When a tire blew out the car simply dropped safely on its fifth wheel



WALLBOARD INSULATED WITH ALUMINUM SHEATH

ALLMINUSE covering one side of a new wathwest is expected to improve its heat-instanting quality. The published metal stops summer heat by reflecting it back as a mirror does light, while in winter it diminishes heat loss by radiation. The metal sheath has been partially detached, in the photograph above, to show core of gypsum board,

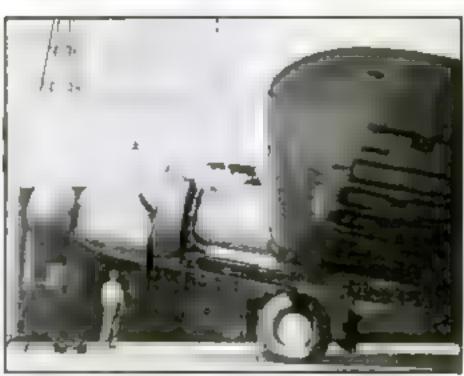
WIRES SLICE OFF PLASTER CAST WITHOUT HURTING PATIENT

WHEN his wife had to be put in a plaster. cast following an automobile injury, W. K. Kearsley, research engineer of Scheneclady N Y, received permission from a doctor to try out a new way of removing such a cast. He had been informed that this was a necessarily trying task, requiring the cast to be softened with vinegar and then chipped or cut away with heavy cutting pliers or saws. At his suggestion, lengths of flexible wire were placed beneath the cast when it was applied. Weeks later, at the tone for its removal. Kearsley attached the projecting ends of the wires to a small apphance like a windlass that he had devised When it was wound up, the wires sheed neatly through the plaster, which then dropped away without disturbing the patient. The invention, adopted by a 5chepectady hospital, may come into general use.



The view of Krakatoa left, as fail eroption, was taken by daring Syers in an airplane as shown in Lower picture. Lavaburned the pianes wings as it skemined the trater a edge

MAIL IN PLANE'S FALSE NOSE



Though it looks as if it carried a hadoon at its note, the airplane pictured above actually owes its odd appearance to an innovation in the arrangement of cargo space. To give the ten passengers more room in the cabin, the mail compartment is placed at the forward end of the fuselage ahead of the pilot and propellers. A curved door at the extreme front, which is seen swung open on its lunges in the pix use provides access for loading and unleading. More than half a ton of air mail may be carried in the new targo space.

TAKE PICTURES OF VOLCANO AS LAVA SCORCHES PLANE

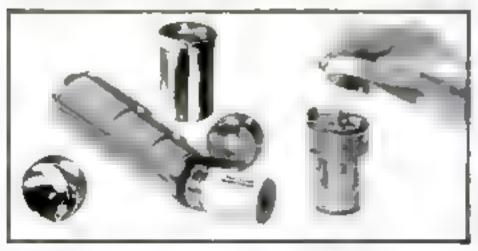
Skimming so close that molten lava spattered the wings of their plane, a during pilot and photographer risked their lives, not long ago, to make close-up pictures of the East Indian island volcano Krakatoa in full eroption. While other cameramen were content to remain at a safe distance in a boat these two fivers, repeatedly banking their craft in the nick of lime to escape the fiery column obtained fine views of the outburst, which continued with unabated fury for forty eight hours. The recent eruption occurred just fifty years after one of the most violent in the world's history—the explosion of krakatoa that his world's history—the explosion of krakatoa that hi



Core of clay to seen at shot from pipe, right, by sir pressure in excavating for a bridge

FLASHLIGHT IS A TELESCOPE

Many useful implements for compers and hikers are combined in a new convertible flashlight. By rearranging its parts, it is readily transformed into a telescope, a candle lamp, a magnifying glass, or a burning glass. The case contains a waterproof first-end but in addition to two standard dry cells. Despite its many adaptations, the nickel-plated case, when completely assembled, measures less than ten inches in length.





The condic lamp, above, is one of many uses of the flashlight seen at left

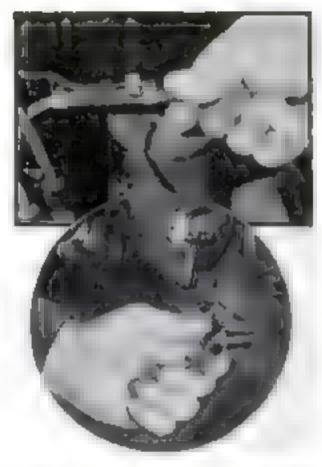
BRIDGE FOUNDATION DUG WITH COMPRESSED AIR

Hugh "sausages" of clay, weighing as much as three toos apsece, are hurled to the surface from subterranean depths by compressed air, in a new method of excavating for bridge foundations. A steel cylinder, four feet in diameter, with a cutting edge on the bottom, is first sunk in the ground, When it is in place, compressed air, at a pressure of 120 pounds to the square inch, is forced in at the bottom of the cylinder. The solid play of clay in the pipe is hurled from its upper end at a speed of 100 miles an hour. The new method is reported to reduce the need for sending men underground to work under uncomfortably high air pressure and also to shorten greatly the time generally required for this work. The workmen, it is said, are in little danger of injury or death when using the air-pressure method and as a result it is expected that this process will gain Javor among contractors.

ROCKING-HORSE TRAINS BRITISH RIDERS

MOUNTED on rocking-horses, recruits of the British cavalry are now receiving prelimmary training in horsemanship. At the Army Equestrian School, at Weedon, England, the wooden horses were recently installed to give rookies the feel of the saddle and practice in mounting and dismounting before they tackle the spirited animals stabled at the school In advanced horsemanship, the wooden horses are also emplayed in teaching acrobatics and trick nding. They are said to be especially useful in helping riders acquire the right balance when g horse takes a hurcle. Dismounting from one of the rocking-horses. by means of the spectacular neck-rols, is being demonstrated in the photograph by the chief instructor





NEW AUTO LIGHT WARNS OF IGNITION TROUBLE

A NEW pilot lamp, attached to a car's dashboard by a screw bracket, warns a motorist instantly of any trouble in the ignition system. So long as the coil and spark plugs are working properly, the window of the indicator, illustrated in circle is illuminated by a red neon light. No direct electrical connection to the car's wiring is needed; a device known as a condenser pick-up is clipped to the wire between coil and distributor (upper photo) without removing the insulation



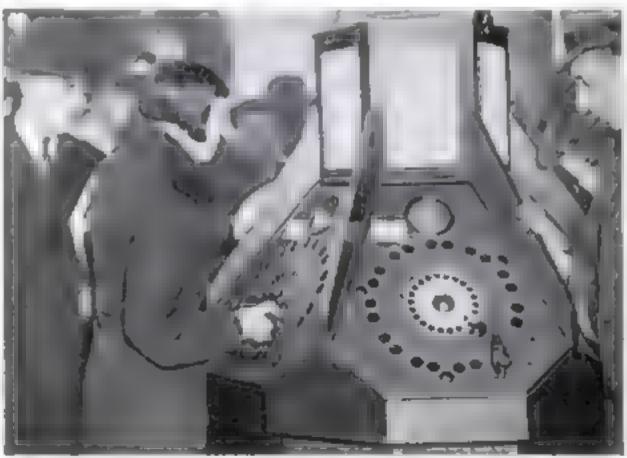
EAR TUBES FOR PHONE MAKE WORDS DISTINCT

Persons hard of hearing, who have dirficulty in carrying on a telephone conversation, are said to be aided by the new set illustrated above. When answering a call, the user places a receiver of conventional design (at right of photo) upon the base of an instrument resembling a physicians's stethoscope. Tubes lead to a pair of earmeces that help to make every word audible. In speaking, the special transmitter, seen in background, is used.

ROBOT GUIDES SUBWAY RIDER IN LONDON

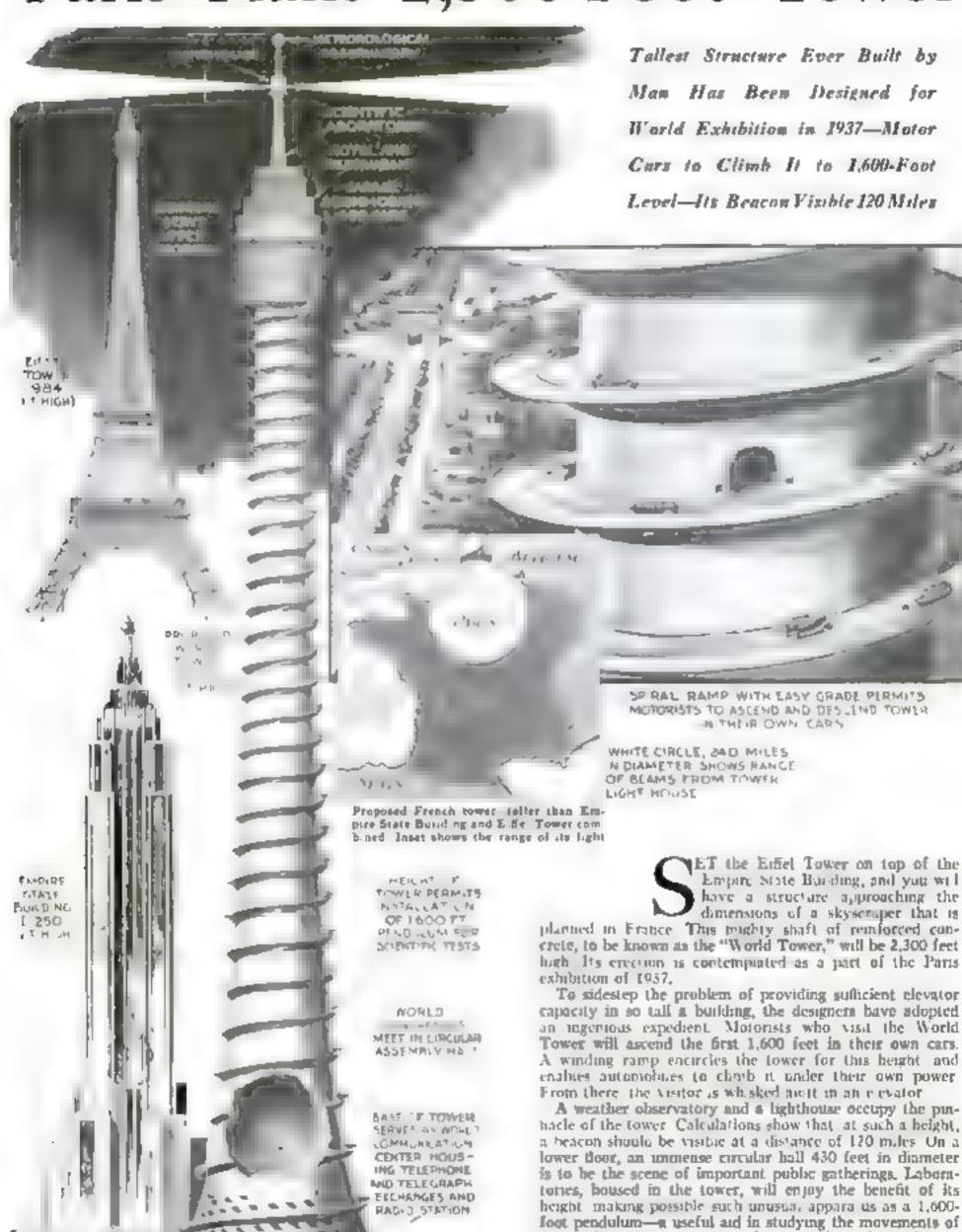
Twenting a dial belos subway riders and their way, at a self-service information booth just opened in London, England, To inquire how to reach any point in the city, the traveler sets the dial ac-

rording to a printed list of instructions. The device then informs him of the place's location, the exact fare required, and the number of the platform from which the appropriate train leaves.



In the subway of London, this automatic information booth has just been installed. From it the travelets can learn, by working the dial. location of a desired spot and how best to reach it

Paris Plans 2,300-Foot Tower



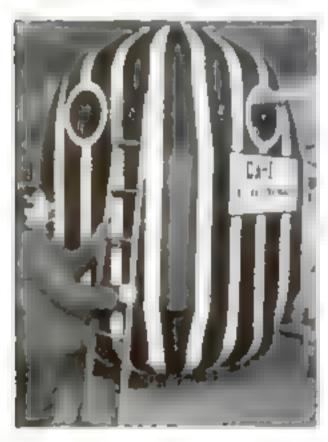
the earth, and in experiments dealing with the laws of gravity. Headquarters for world communication services and for the press are in the tower base. Revenues from all sources are expected to pay for the tower in forty years.

Drives Midget Car Right Through Doorway



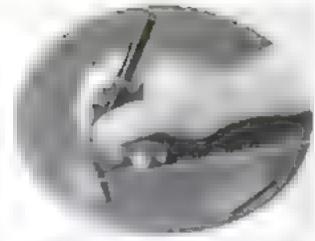
This car ama I enough to down through the document of a house, was fash used from the change of a midget note.

RUSSIAN BALLOON TO INVADE STRATOSPHERE



A new challenge to the ten-trole altitude record of Prof. Auguste Piccard, made last summer in a globe hermetically seared and carried aloft by a huge balloon. is offered by Russian scientists, who plan a similar ascent next month. Their balloon is being rushed to completion for the attempt, and an air-tight cabin is being built that will protect the flyers from lack of oxygen and reduced air pressure. A model of the cabin is illustrated above,

WHEN he reaches the scene of an indoor spraying job, one British contractor does not leave his car parked outside, but drives right in through the doorway! His midget auto was fashioned from the chassis of a standard make of small car, which was remodeled to even more or mir utive size so that if would pass through an aperture only twentyeight inches wide Spraying apparatus is mounted on the rear and the operator moves it about Indoors with the labor-saving aid of be car teself which uses very little gasoline



PENCIL TRACES GARDEN LABELS ON COPPER

LETTERING traced with a sharp-pointed pencil upon a new plant label for the garden will withstand indefinite exposure to the elements, according to the maker. The label is faced with a thin sheet of copper, backed with cardboard. Writing indented in the soft metal by the pencil point, in the manner shown above is preserved long after the lead marks themselves are effaced.

BOTTLES HOLDING SHIPS ARE LOCKED TOGETHER

PUTTING a abip model in a bottle is not sufficiently difficult to suit Charles V. Nielsen, expert model maker of Hasbrouck Heights, N. J., so he has devised the remarkable ornament pictured at left. Twin ships in bottles are joined by a vick

that bears two pegs at each end, preventing its withdrawal from either bottle neck. Nielsen accompashes the seemingly impossible feat thus. First the ships are folded and slipped into the bottles, the masta be-

ing raised in the usual way with hooks and threads from outside Then two pegs are dropped in one bottle. The connecting stick is now held in the neck, and the bottle is juggled until a peg fals into a hole pre-

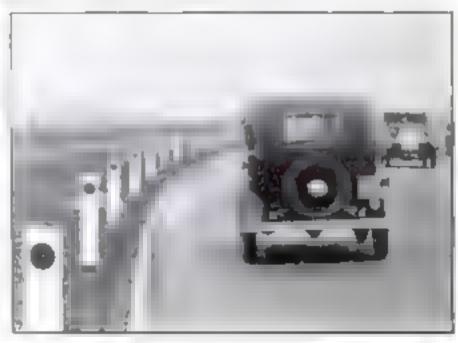
is now held in the neck, and the bottle is juggled until a peg falls into a hole prepared with 4 drop of glue It is shoved home by pressure against the bot le



Charles V Misses with two ships-in-bottles fastened together with a suck so pegged that it cannot be removed

BULL'S-EYE FENCE POSTS GUARD BRITISH ROADS

BULL'S-EVE fence posts safeguard night privers against running off the road at dangerous curves of a highway near London, England. Red redectors, resembling the individual danger markers used in this country, are sunk in the white posts and are brilliantly illuminated by the headlamps of an encoming car. The unfamiliar position of cars and posts in the photograph is explained by the British custom of keeping to the left.



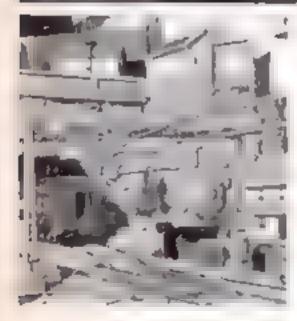
Bulls-eye posts guarding a curve on a highway in England

Model Railway Looks Like Real Thing









Teres are right and of the rest are restricted as the restricted and a speak a

Despit the picture inghir 1 cales a vice a eac a way a variable printing use in har go a foreigness has the constitution by a cale of the real small property by the man mint which scenes are tall a expenses and the being

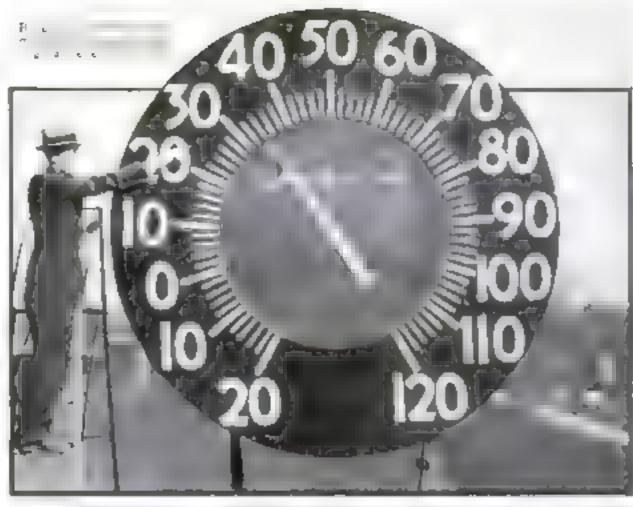


HOTEL GUEST SELECTS ROOM FROM PHOTOS

THEOCOH a system just introduced in a Pattsburgh, Pa., hotel, a prospective guest sees just what his room will look like before he is taken to it by the bill boy. On each side of the registering desk photographs of the available rooms are displayed on a vertical board. The clerk with these photos, describes the room



Pictures of thomas in Printhurgh botal are ar-

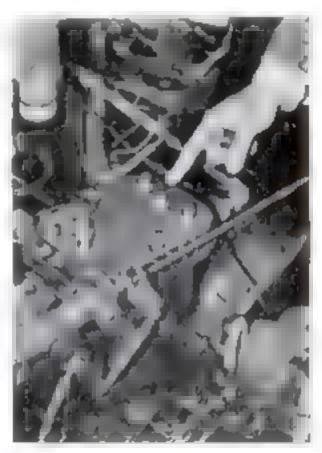


BIGGEST DIAL THERMOMETER IS ON ROOF

Motivited on the roof of a high building at Rochester, N. Y., the world's largest dial thermometer tells the temperature to observers blocks away. The face of the giant instrument is taller than a manand a revolving indicator, painted white, points to figures a foot high. A large manufacturing plant erected the novel landmark as an advertisement for its products. In spite of its great size, the instrument responds accurately to all changes in temperature

MICROPHONES CONTROLLED BY WIRES





EXPERTS WATCH FLAME IN MOTOR'S CYLINDER

To study the manner in which flame spreads through a cylinder of a car's motor when the spark plug ignites the fuel mixture, experts of the U. S. Hureau of Standards have constructed a special cylinder equipped with windows, as shown above. Thirty-one symmetrically-spaced apertures in the top of the head permit the time of arrival of the flame at each point to be observed. The experimenters use a stroboscope which makes rapidly-moving objects appear to stand still.

Find Fortunes in American Gems



NEW MICROSCOPE FOR AMATEURS

ESPECIALLY designed for the amateur who cannot afford an expensive instrument, a new microscope, introduced by a well-known optical firm, fulfills all needs at low cost. The instrument magnifies 100 diameters, and is provided with rackand-pinion focusing and removable mirror, As an additional aid to nature study, the

maker has developed a mounting set so compact that it may be carried into the field. The outfit includes, among other thinks. specimen box, preserving jar slides, dissecting needles, cover glass, dropper, alcohol, and Canada balsam



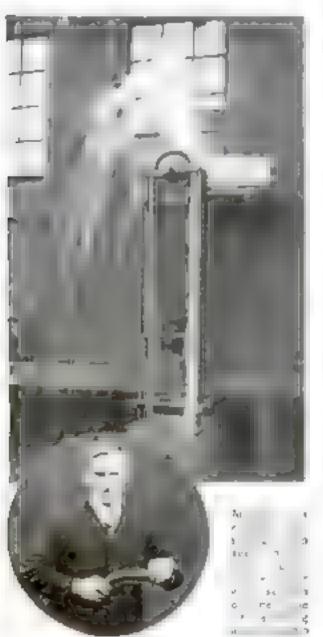
PISTON RING FILE HELD TO CYLINDER HEAD

COUNTLESS steps between the bench and the job are saved by a new piston ring file, that clamps directly to stud or cap screw in the cylinder head. The ring is held against a V-shaped plate and moved back and forth along a guide. while fingers press the ends against the file, as shown above. A few slides backward and forward give un accurate fitting in a fraction of the time usually required and with a minimum of effort, according to the maker



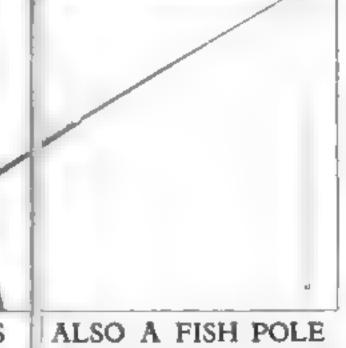
ENDLESS COIL SPRING USED TO PUMP WATER

Picking up a coil-spring curtain rod that had failen into his bathtub. C. P. Frederick, of Seattle, Wash,, was surprised at the amount of water that clung to the coils. The observation led him to design a new form of pump to raise water-on endless coil spring, running over a pair of pulleys, that dips in water at its lower end and throws it off into a collector at the top. Frederick plana to use the pump for tragation and drainage



WALKING CANE IS

A CANE that turns into a fish pole, as demonstrated above, permits a fisherman to try his luck whenever he encounters a promising stream. Telescope fiber sections join to form a hollow



shaft through which the line is threaded from a detachable reel. The curved hapdle holds books, small sinkers, and an extra fine. When closed, the cane is of conventional aimenfance

änepp ug disk.



Timing Camera takes 2,000 Photos a Second

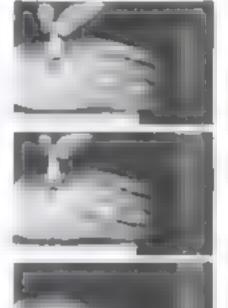


New a transpared a ming camera with side removed. Pinger points out 15m ng dial which is photographed by one sens

SPLITTING a second into 1,000 parts, the world's fastes, timing camera was demonstrated recently by engineers of the Electrical Research Products laboratories in New York City It resembles in principle the cameras used to time runners at the Olympic games last summer, but it is 125 times faster. As a result of this great speed, the new camera will permit scientific work hitherto impossible. From eight to 2,000 pictures a second may be taken with ordinary lighting equipment.

Ultraspeed cameras have been constructed before, but the new instrument is the first to provide precision timing, in addition. While one of its two leases records the action on the film, another is trained upon a set of revolving dials that register on every frame the exact time in minutes, seconds, and hundredths of a second. By estimating fractions of scale divisions in the timi-hed record the exact time may be gaged to a thousandth of a second.

Tests a ready made show the new camera's possibilities. Used to study the burning of photoflash bulbs used by photographers, it revealed that a subject who wanks does so after the light has gone out. A man whose hand was touched momentarily by a lighted digarette took more than a quarter of a second to react to the burn and jerk his hand away. When a glowing electric light bulb was shattered, the filament burned for a second



HOW FAST A BALLOON BURSTS

Vowa sight token consecutive y by a superspeed camers, show that a balloon, touched by a burning signresse, will burn so fast that the timing dain can scarcely make a record.

BURNING YOUR HAND

Three photos, left, above what happens when I ghood cigarity touches hand Second view shows eigenest removed become the hand starts to jeck eway It takes a quarter of a paramilinactive to





CROOK DEALERS FOILED BY PACKAGED MOTOR OIL

Moror oil packaged and sold in round cans, with the aid of a newdispenser, now foils the vendor of bootleg lubricant. Sharp-pointed prongs drain the original can in the motorist's presence. Thus he gets the brand he asked for an the can, once empty, cannot be refilled.



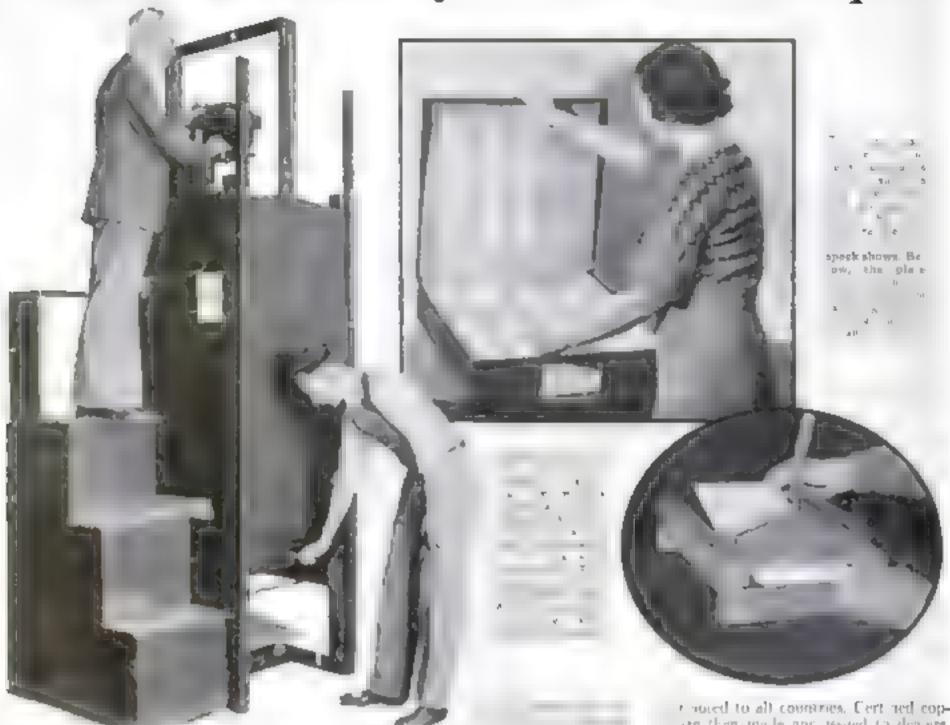
M e fr o h e a gr h e a gr h e a gr h h w gr y s h heder yy Right, Grorge E Sanders, New York raiomologish with h s re - a h s to -

MODELS AID FIGHT ON INSECT PESTS

To illustrate his lectures on methods of combating insect pests, George E. Sanders, entopologist for a large New York chemical concern, has constructed enlarged models of famulac parasites. Faithfully copied from the insects as seen under a microscope, but enlarged as much

as 100,000 times, they give a startling inpression of realism. With the models' aid Sanders explains why the chewing pests, such as caterpillars and potato bugs, must be destroyed by stomach poisons, while the smaller sucking insects are attacked best with chemicals that kill by contact.

Grade Cotton by Guarded Samples



RMFD guards keep wat a over a lead- med casket in the U. S. Treasury at Washington, D. C. It holds only twenty cardboard boxes stuffed with samples of cutton—but these samples with duplicate sets in other cour ries. constitute the final court of appeals for grading 25,000,000 bales of cotton that enter he woring trace every year

Once the Liverpool market was the su-

HE & N. DEPART HERE of Agriculture with is improved grading methods, safeguatus the world supply. Every other year its experts prepare sixty-five dupurate boxes of standards for each of the twenty recognized grades of cotton. Each box contains n dozen samples from different baies of that grade, so selected as to show permissible Variations in color and texture When inspected and approved by an intetrational committee, the standards are r noted to all committee. Cert red copwe then made and usued to dealers.

Not overlooked is the danger that a criminal might somehow succeed in substituting inferior samples for the genuine ones. This would constitute a monster fraud that would permit the said of low-grade cotton at a high figure. Hence a photograph of each box s contents, imprinted with the seal of the Department of Agriculture, is pasted inside the hinged cover. Alteration of a sample could be detected by matching it with the picture, which is made by a special process.

ELECTRIC CABLES PUT IN "SUBWAY"

A VERITABLE subway for electric cables, just installed in a San Francisco channel by Partice Gas and Electric Company engineers, is experted to care for the needs of the community for a cen-Lary to come. Engineers constructed two concrete sections, pierced with conducts, each 120 feet long and weighing eighty-five tons. Detricks lowered the sections into a trench nine feet below. the channel bottom, as shown while a diver directed the work by telephone,





of Lake Michigan. Grass and trees and towering buildings cover them and hundreds of thousands of glowing, gas-filled tubes illuminate the great exposition

Covering 338 acres, the thousands of exhibits compress into the scope of an exposition the drama and wonder of history's most amazing century of scientific advance. Under your eyes, crude rubber changes into auto tires; casein, extracted from mak, becomes a fountain pen; piles of parts turn into auto-

mobiles that speed away under their own power

You see icicles forming on a red-hot wire and fisten to an eight-foot talking tooth. You watch the blood circulate through the veins of a transparent man, read the temperature from a 200-foot thermometer, and see an umbrella made of water, Artificial Northern Lights flare and flicker in rambow hues; educational pictures appear on curtains of steam, and prehistoric monsters, mechanically reproduced feed and fight as they did millions of years before human history dawned.

Everywhere there is action. It is the key to the whole thrilling panorama. The exhibits at the Chicago Exposition

show processes instead of products. They demonstrate how things are made and give exciting glimpses behind the scenes of science and industry

Abstruse scientific laws, for instance, are made plain by athletes riding on whirling disks. How twigs grow and flowers are fertilized are shown through elaborate moving mechanisms, To make possible some of these exhibits, whose new machines had to be invented.

The central building the great nine-and-a-balf-acre Hall of Science, shown at the head of this article is like a 300-ringed circus, every from containing its fascinating bit of dramatized human knowledge. In the physics section, more than a hundred displays turn textbook principles into action, light, and color. Here a three-foot raindrop atternately evapora es and condenses from morning until night. Two hundred white haitard hails clustered in a depression at the center of a huge black table represent the molecules of water in a raindrop. At the center of the depression, a square block of wood rotates at varying speeds, high speed corresponding to high temperature and low speed to low temperature. As the rate of rotation increases, the bails, struck by the projecting corners, bounce out of the depression and roll over the black table just as molecules leave a waterdrop when it begins to evap-

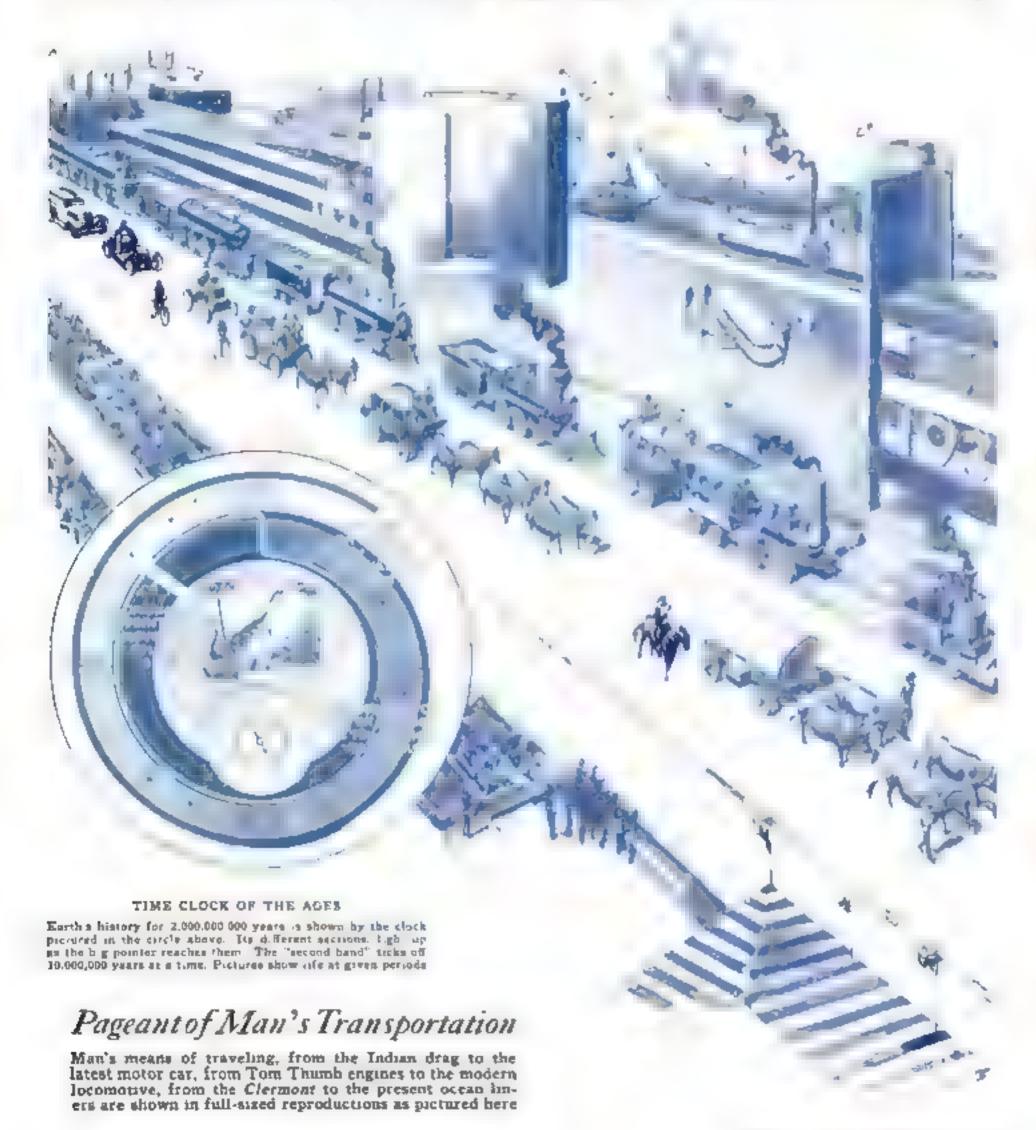
orate. When the block is spinning at top speed all the balls are josting over the table and the depression is empty. The randrop has evaporated. Then the whirling back slows down and the molecules roll back into the depression, condensing once more.

Nearby is shown a bewildering feat of scientific magic. In a glass case an icicle is slowly forming on a red hot wire. The expandation is that the air has been practically exhausted from the container. Consequently, when waler is fed to o the vacuum chamber along the wire evaporation, and the restating cooung, as so

rapid that the water turns to ice in spite of the heat of the wires.

Another glass chamber reproduces in miniature Piccard's flight into the stratosphere. Spec afors see how the gas within a tiny bolloon expands as the air is pumped out of the bell jar until the pressure corresponds to that of the rarefied atmosphere ten miles above the surface of the earth. Then they watch it contract again during the return journey to sea level.

In the mam ball, below, they can examine the actual sphere of aluminum in which Piccard rode to his record height



PECTACULAR and ingenious exhibits, being prepared for the Cen tury of Progress Exposition at Chicago, have been described in the pages of this magazine. Last month a feature article explained the elaborate plans of the U.S. Government. Here a staff writer for POPULAR SCIENCE MONTHLY, with the assistance of a staff artist, presents a vivid view of this great pageant. You are taken behind the scenes of some of the most amazing exhibits and told how their startling effects have been produced.

and beside it the steel bathysphere in which William Beebe descended 2 200 feet into the ocean off the shore of Bermuda

AN UMBRELLA of water forms an-other spectacular display which demunstrates the force of surface tension in liquids. Running down the outside of a pipe, water is deflected by a broad-based cone at the bottom into an umbrellashaped film which breaks into drops at its outer edge. When a little ether is added to the water at the top of the pape, the tension is broken. Instantly the umbroils collapses, opening again when the effect of the ether has passed away

To make the exhibit even more striking, beams of light are shot down through

the film so they are invisible until they reach the outer edge Here they strike the forming drops that gleam and glitter like a border of flashing diamonds.

One whole room in the physics section is devoted to rays of various kinds. Just what hap-pens inside a human

eye when beams of aght strike it, is illustrated graph cally by a huge tross-section model. Seven rays trained upon the shifting lenses and

Drawings by B. G. Scielstad

moving retinas of this three-foot model, demonstrate how eyes of normal vision, farsightedness and nearughtedness focus upon the same object.

Not far off among the medical exhibits, is a giant model of a throat. Vocal cords of variable tension demonstrate why one voice as boss and another soprano. Beside it is a monster brain lighting up different areas, which control various functions of the body, when correspending buttons are pressed by spectators

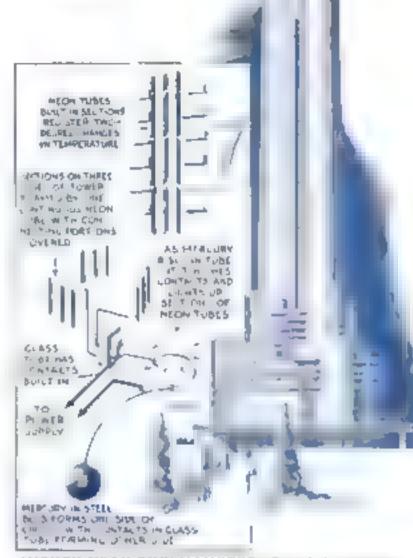
Towering eight feet in height is the talking touth. A concealed projector behind it traces the processes of decay on the front of the tooth while a voice, coming from records which are synchronized with the projector, gives a lecture explaining each of the half-dozen steps shown. The whole apparatus is nutomatic, the pressing of a button producing one cum, rete cycle of the show

Close to the talking (ooth is a magic book whose pages, each eight feet ligh and six feet wide turn by themselves and carry information about the care of the body

Next there is a robot with a leather heart and glass-tube arteries demonstrating how red blood is pumped from the heart and bute brood returns to it. The different-colored fluids appear to course back and forth in the same tubes, one color running down and the other color up. In reality, double tubes are employed, the one inside conveying the red bound and the one outside carrying the blue.

IVING X-ray eyes to the spectators, G another exhibit shows a transparent man, a lifesure model of the human body composed of a glassy cellulose material. The organs inside are illuminated electrically in rotation while their functions and relationship to one another are

> explained. In addition, the observer sees the complete skeleton of the figure the veins and arreries of the circulatory system, and the network of nerves that he beneath the transparent skin.



MIGHTY MEON THERMOMETER One of the apeciacufor a ghis at the Chicago Pe r is the 200-foor thermometer, Despite the huge size, this temperature recorder is accurate

The location of the various glands, the arrangement of muscles, and the working of the digestive system are also pertrayed so visitors get a clear picture of human anatomy

ANOTHER robot, in the chemistry section, is even more spectacular. Standing ten feet tall on its steel feet, this 1 500-pound metal man has a skeleton of aluminum castings, steel, brass, and lead weights. It turns its head, moves its lips and extends its four-and-a-half-foot arms in blebke restures under the direction of a small electric motor that forms the brum. When the vest of the huge mechanical man is unbuttoned, it reveals a white screen beneath. By means of a combined speaking mechanism and moving picture projector within the body, the robot gives a twenty-minute lecture upon food chemistry emphasizing various facts by pointing to its own thuminated digestive organs appearing upon the screen.

One of the most difficult of all the exhibits to prepare was a diorama or three-dimensional picture combining a painted buckground and modeled figures, which shows how sulphut is mined by driving superheated water into the ground



The animated achieve pictured above, abowe how a navigator finds the postured of his vector. At less arrings represent highla taken up two a are used to enjuristing post true by triangle arises when our of eight of land. Right meen tubes demonstrate the method used in computing the distance from shore by means of observations taken up a lighthouse while the thing is cruising clung within eight of the coast.

and floating the melted mineral to the surface. More than three months of experimental work was required to devise the elaborate arrangement of tubes and cylinders, wires and heaters, which reproduce in miniature the mining operation.

Vivid tongues of whirling flame, hquids that shift colors like a chameleon, and a twenty-five-foot "living" table of the elements are other dramatic displays in the

chemistry group. Besides exhibiting specimens of most of the ninety-two chemical elements of the earth, the table displays a ten-foot revolving globe indicating the main sources of the different elements.

Dramatizing the story of the earth and life upon it is a geological Time Clock of the Ages which compresses two billion years of history into the space of four minutes

IKE an eight-foot snails shell the face of the clock is formed by a widering spiral along which an illuminated pointer travels, each brilliantly-colored sector of time lighting up at its approach. The principal events upon earth, such as the first appearance of life, are marked by stars. At the center of the clock is a screen, three by two feet, upon which appear, at eight-second intervals, pictures showing conditions on earth at the time indicated by the traveling pointer. Below the screen, a "second hand" ticks off the time, each tick at first representing

a lapse of ten million years. Later, when more things are happening on earth, the band automatically slows down. Man appears just when the final tack of the clock is sounding.

As you move on to other exhibits of the geology group, you watch miniature rivers, canyons, and deltas form under your eyes; you follow he history of petroleum from its formation in the ground to its final emergence from the refinery as gasoline you see synthetic sand dunes form and slowly march back and forth in the grip of shifting winds

A machine that makes mountains is another unusual contrivance. Layers of sponge rubber, weighted down with lead shot, represent rock strate in the earth berew mechanisms at nither end slowly

Standing on this revolving platform, the man with the dumbbe is speeds or cetards the revolutions by holding the dumbbel spear to, for for from, his body



This heroic reproduction of the human eye presents a graphic demonstration of the mechanical of vision. Lenses are moved in front of the eye a lens to show how glasses current defective eight

· Animated Panorama Gives Exciting Glimpse

compress the layers to reproduce the folds and thrusts which, on a titanic scale in the earth's crust, have brought about

the Rockies and the Andes.

In the reproduction of the sand danes, a fourteen-foot diorama depicts a scene along the southern shore of Lake Michigan between Gary and Michigan Cirv. Ind. Fine grains of a light onde are employed as sand. In an endless circular tunnel, of which the diorama is port, a hidden fan sends a steady current of air over the sand beaps, piling them into great mounds that move slowly along the shore burying ministure focests and tiny houses which he in the way. Then the fun is reversed, sending the wind through the tunnel from the opposite direction, and the shifting sand hills march back again across the stage bringing to light once more the buried trees and buildings.

TURNING a mathematical formula inempossible but that is what is done by one exhibit at Chicago. An athlete standing on a small platform, holds two from tiumbbells extended at arm's length at other side. An antial shove starts the peatform turning almost without friction on its ball bearings. For a few moments. it continues to rurate at the same speed Then a show of seeming magic starts The pibliste draws the dumbbells in to has chest. The platform speeds up. He extends his arms again. It slows down. He draws the weights slowly in to his hody and the platform which at a steadily increasing pace. A dozen times, you see this welrd performance occur, giving a demonstration of a basic law of mechanics relating to mass, force, and acceleration,

Other moving displays, by means of varicolored streaks of light, weights that



An illum-nated eight not flower in fertilized by a preel built that represents a g sin of polen and rol a down to start the development of seed in the ovola. Light stresss show the progress of he pulses. The inset shows the invo ved. mechanism behind the picture that controls operations

fall humping through mazes of steel pins, and toy ships the steam among the islands of a papier-māche ses . ically other

On a screen representing his stomach, animated pictures are thrown while the 1500-pound robot gives a twenty moute lecture on the chemical process of digestion, indicating the various meps

representing a grain of pollen, tolls down the face of the pacture from the upper male flower and comes to a stop as it touches the pistil of the

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female Then a streak of light moves down the pollen tube and shows the path the polien takes in reaching and fertilizing the ovules

Four illuminated pictures, appearing one after the other to the left of the flower, give magnified views of the fertilized ovule showing different stages in the development of the seeds. In the meantime, the ball has rolled, as if by magic, back up the face of the picture and is in position to start the show all over again.

THREE electric motors, a magnet on a moving arm, a transparent, revolving box, and an claborate system of weights and counterweights are required behind the scenes to make this demonstration possible. An electro-magnet moves along a strip of brass behind the steel ball leading it along from

flower to flower. A placing plutter, slowly opening and closing a plit, lighted from behind, produces the illuminated path of the pollen down the tube and a revolving box, having its four transparent sides I shied from within, shows the four stages of seed development. The whole process is automatic, a central commutator controlling the timing of the various units

MOVEMENTS OF

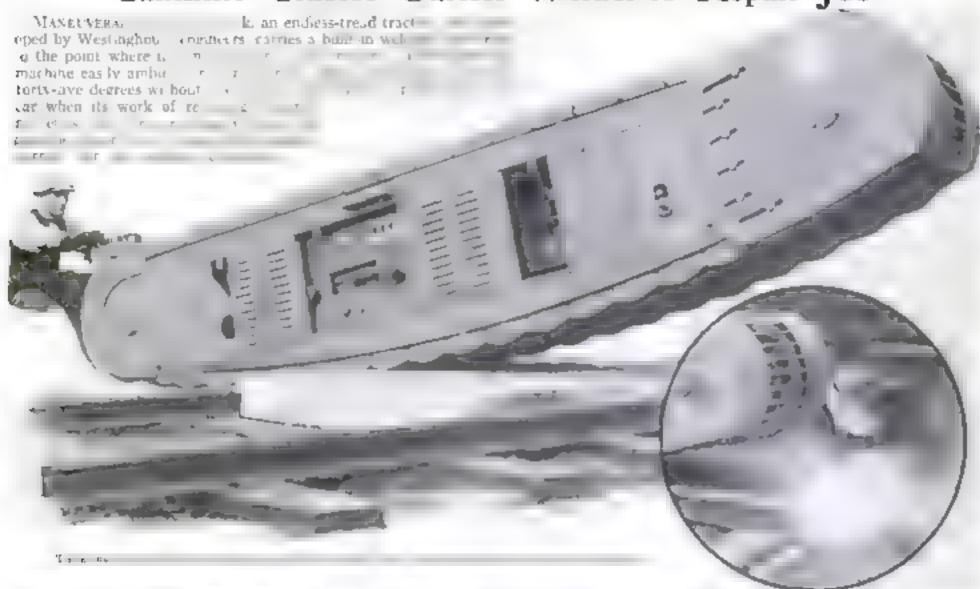
ICLLIN DUST

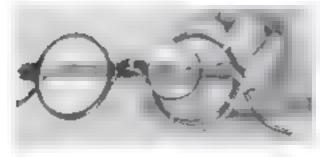
Beyond the flowers, six projection outfils, called micro-vivariums, make Visible the strange, infinitesimal world which lies m a drop of water. Each apparatus throws a buge disk of light upon a screen and peoples it with the magnified images of microscopic creatures, enlarged thousands of times. You see these monsters of a minute world dark about, forage for food, fight, reproduce

The impression, as you pass from the disk to another, each showing a different sort of microscopic colony is that of looking into the tanks of some aquarium filled with most (Continued on page 91)

Behind the Scenes of Science and Industry

Tanklike Tractor Carries Welder to Repair Job





EXTRA EYEGLASS LENS CLIPS TO ANY FRAME

Designed to be clapped to the frame of a pair of spectacies, a new type of lens enlarges reading matter so the use of a hand reading glass becomes unnecessary. It is roughly the size of a quarter and is held about an inch in front of the regular spectacle lens. The clip, of spring metal, may be anapped on or off any shape of frame in a moment, When reading matter does not require magnification, the lens can be thipped upward on its hinge out of the line of vision. A small coil spring holds it firmly in this position.

COLOR OF FLAME REVEALS GAS LEAK



Gast's hat leak from refrigera ing plants and other fumes cificult to detect by ordinary means, are quickly revealed by an ingenuious burner patterned after a blowtorch. The device, burning alcohol, normally has a clear blue flome. When a rubber tube on the torch is held near a gas leak, however, as shown in the photograph at the left, some of the gas is sucked through the tube to the burner and the flame changes color. If the flame turns green, for example, when the tube is held near a suspected pape connection, the source of the leak has been found. The method is said to be especially useful when the escaping gas is of an odorless type, and therefore more troublesome to trace than fumer can be detected by the nose.

ICE-TONG LIFTER FOR RESCUE WORK

Working like ice tongs, an ingenious tescue de vice enables an invalidato be carried safely from a burning building. Metal loops grasp the human burden; the greater the weight, the more firmly they grip. A leather strap encircles the rescuer's neck, leaving his hands free. The inventor also recommends his device for use in hospitals

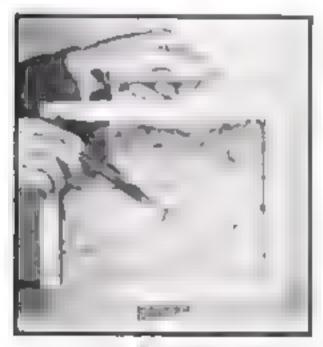


Working like too tongs, this lifter a gr p is increased by the weight raise Right lifting an invalid with the devi-

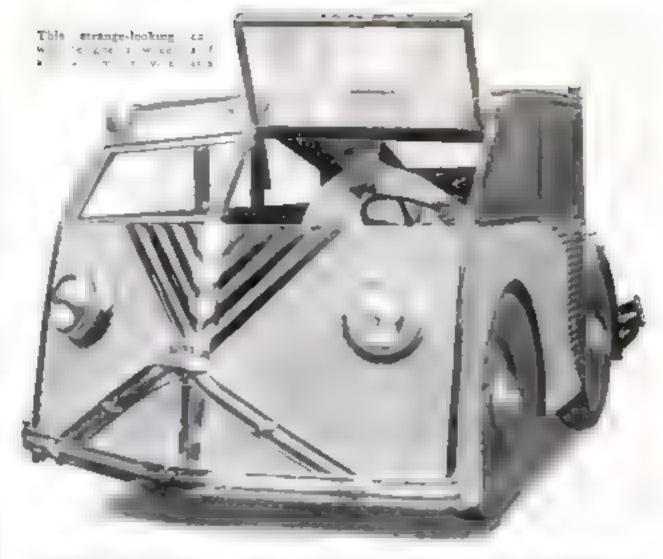


WONDERS OF ANT LIFE SEEN IN GLASS HOME

BETWEEN two photographic plates, held in a wooden frame, a New Hampshite naturalist placed dirt and thus constructed an anthouse with transparent walls. By this means the activity of an insect city is easily studied. The tunnels and subterraneau chambers made by the ants are clearly visible and their work can be seen from each side of the glass home. The transparent cages offer more varied activity than a goldfish bowl, and the ants require much less attention than goldfish. The case is provided with a handle



Two pages of glass, with dirt between them make home in which and it studied



TURTLELIKE CAR BUILT OF OLD PARTS

From space auto and motorcycle parts, a Chicago mechanic has built a freak we hicle which be calls a "turnle on wheels. The total cost, he says, was about twenty-five dollars. Made of corrugated metal, the turtle-shell body extends beyond the

wheels on each side, reducing wind resistance. On country highways, according to the builder of the strange machine, the little car makes forty-five miles an hour, driven by a motor placed at the rear A special triangle of humpers protects it

DIME PUT IN SLOT RINGS DOORBELL

To save a busy housewife from frequent annoyance by unwelcome callers, a cloorbell that works only upon the insertion of a dirne is soon to be marketed. The com slides into an inside receptacle where it closes an electric contact that permits the bell to be rung. If the caller proves to be a friend, the dime in returned as the guest enters, if the visitor is a stranger or one to whom entrance is returned to the money is retained. Dimes kept by the nevice provide a fund for charmes

Only after a cose has been deposited to the a ut. as shown at the right, does the doorbell ring. The house-wife can thus be reasonably sure the catter is one having legit mate but note with her. This protects her against the otrusion of annoying or casua, callers.

The interior of the com in alot doorbell is shown above. The com andeainto receptacia mande the door where it closes electric contact and rings bell. Housewife can seture the money



TINY MICROPHONES HELP SINGER MAKE RECORD

Miniature microphones, placed on a singer's chest and forehead, as shown above, supplement standard equipment in making electrical transcriptions at a Los Angeles, Calif., studio. By this method, the originator says, it is possible to make a record that sounds even better than the voice of the performer in person, since the small microphones park up tones undistorted by faulty nose or mouth (echnique,

Lost ()il Fields



NABLEOUS treasure in the words lost oil fields is today the goal of a new search. It is being sought by a new school of scientific detectives-men who read clues from microscopic bugs dead millions of years, or from photographs snapped from an airplane at a 10.000-foot altitude; who sound the earth with miniature electric vibrators, release magrating electric currents to explone hidden depths, measure changes of one-millionth part in the earth's gravitational field, or follow a trail of radium to subterranean levels never before probed by man

The lost oil fields are those passed over by explorers of other days who were unaided by magern science. Some are deeper than ever the driller's bit has penetrated and can be reached only with the aid of machinery of hitherto undreamed power. Others he locked in blind formationshuge subterranean domes whose contours are invisible at the surface, and whose discovery depends upon ultra-modern geological methods. Still others have been penetrated by wild-catters in the past, yet were not detected by drillem unaided by delicate chemical tests lately devised. In such fields remains the bulk of the world's untapped store

Hidden beneath flat, marshy sands along the ocean lay one of California's lost oil fields. Close by, several wastcat wells had seen abandoned as far uses. Then along came a generagist of the new school. From the unsuccessful drilers, he obtained cores from their wells-long cylinders cut out of the earth by a het shaped like a cookie-cutter. These were perfect cross sections of the underground strata. The grayness of the cores was flecked with thry pin points of white, like minute specks of chalk. Crushing the cores, washing them, boiling them in tyo to remove the hinder material, this geologist picked out the tiny specks and placed them upon the slide of a microscope. Under the tern, he saw beautiful sea shells, glistening and perfect

PAGES of earth's history turned back. These minure forthat lived when the earth was young. Each species repre-sented an epoch in which myriads of such minute bits of life flourished and died. This, brought up from a certain depth, represented the Phocene; this, the later Miocene; this, the Oligocene, dating back stateen millions of years. Aided by this geological calendar, he identified each formstion. Here is was found at 3,000 feet, here it rose to 2.600; here, nearer the ocean, it was still higher

Mentally extending these bioden contours, burned beneath the accumulated deposits of later ages, he saw them sweep upward to form a great dome. At the crest, in a formation known to be oil-bearing in other regions, he visus used a pool of oil tising on subterranean currents of water to the highest point possible, and so trapped underneath the rocky cap of the dome.

"Drill bere," he said.

Six thousand feet beneath the flat marsh at the point

be indicated, they struck oil

News of oil travels fast. Machinery costing \$28,000,000. rapidly transformed the area into a forest of derricks-150 erected within a year. The production became so large. it temporarily upset the market and sent the price of this grade of oil tumbling to half its former value

So was born the new science of micropaleontology, Now, only three years later, most of the major oil companies maintain staffs of these men who examine cores, classify the various types of "bugs," or foraminifers, and make charts showing the depths at which each of the hundreds of types is found. From fresh cores of driding wells, they read fascinating stories of past ages when the ocean swept



lining the hidden oil forms

of a formation we "re! T"

tion. Right, the B -

company with which I

By STERLING GLEASON

Left, a typical off field with its forest of derricks mark a rise camps of a meaning of a meaning to sait domes. The plugs of fosible alloys, have the camps of t

Microscopes, airplanes, and electrical devices now used in mapping the treasure-holding domes beneath earth's surface

over the places where oil is being sought for beneath the ear his surf a

tish scales, spaces of sea trebus, wood fragments, and pieces of lighte coal or an great abundance in some wels." Earl B Nonle geologist, to dime "Shark teeth, crab claws, worm borings, and fossil fish are occasionally found Even ripple marks, mid tracks, and rain marks can be recognized

A few days ago a gas brow-out occurred in an oil field. Many of the people watching the well were surprised to see perfect little shells appearing on the hats and shoulders of their neighbors. It literally was raining fossils, for the well had penetrated the Amnicols zone and

was blowing these tiny shells high into the air.

Although some fossile are found at almost all depths, certain species had a life history quite short, geologically speaking, and hence clearly define their epoch. These markers tell the geological story of the area with great precision.

In a flat, barren region of the San Joaquin valley in California, geologists suspected the existence of an oil or gas formation. Instead of dralling at random, they put down a series of core-bales at chosen points. Correlating the bug indications from the test-holes, they mapped out a subsurface picture that indicated a favorable formation.

The discovery well ran into a gas sone which blew out with pressure of 60 000 000 cubic feet of natural gas. As subsequent wells were drilled around the geological bullseye in accordance with the directions of the hug-men, the outlines of the hidden dome began to appear with fascinating symmetry. The completed group of wells forms an ellipse, perfectly egg-shaped. This scientifically developed field now supplies San Francisco and neighboring cities with natural gas.

Fortunate discoveries, indeed, are these new scientific aids, for hidden in such blind formations, with no outward indications of their structures, lie the great oil sources of the future "Ninety per cent of the fields of today," a leading geologist

lis appearing on terally was rainmicels zone and depths, certain by speaking, and tell the geologic tell the geologic depths and tell the geologic depths are tell to geologic depths and tell the geologic depths and tell the geologic depths and tell the geologic depths depths and tell the geologic depths dep

Even as he spoke, brand-new methods and theories were being tried in the laboratories and workshops of inventors and experimenters. Not far away, two men stood upon the detrick platform of an old oil well, listening intently to the sounds that came to them through wireless-type headphones. A third man slowly paid out a light steel cable into the hole.

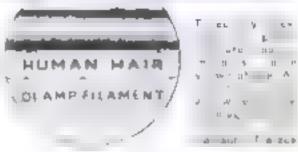
To the ears of the listeners came a regular, measured clanking; for 5,000 feet below, a minuture electric hammer was tapping the steel casing with regular, rhythmic blows. As the strange instrument passed downward, the listeners jotted down notes, while the third man read off the depths from an indicating dial actuated by the moving cable

This remarkable device, still in the experimental stage, is the invention of Haskell M. Greene, of Santa Fe Springs, Calif. With it he explores oil wells to determine whether the casing is tightly set in solid rock, remented, or free. He hopes to be able to go into old wells whose drilling records have been lost, and determine where (Continued on page 95)

Loudspeakers Page Hospital Doctors







TINY FUSES TO GUARD DELICATE INSTRUMENTS

Housekoup fuses are giants compared with a sense of miniature fuses recently placed on the market. The smallest of these is made of platinum were one thirtieth the diameter of a human hair. It is so delicate it cannot be seen by the naked tye. A current exceeding a hundredth of an ampere will cause it to fuse and break the circuit. The new fuses are designed to prevent barmful overloads in radio tubes and in delicate electrical measuring instruments and other equipment operating in the range below one ampere.

SPECIMENS WHIRLED ON DISK IN MICROSCOPE

the volume of the loudspane

Tiny cells are whirled to destruction, while powerful lenses magnify the miniature cataclysm, in a new microscope centrifuge perfected by Dr. Gustav Fassin. University of Rochester optical expert and shown below Specimens piaced on a whirling disk within the instrument are spun at a speed of four miles a minute. By catching glimpses of the cells as they become distended and break, scientists learn more about their composition. The centrifuge will belp the fight on germs.



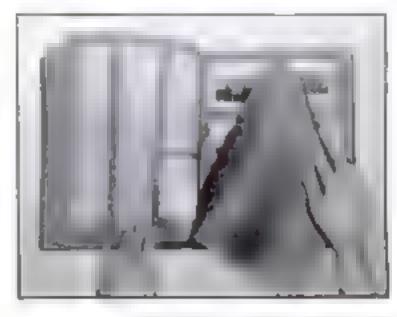
MAP COAST WITH LONG-RANGE CAMERA An out instrument aboard

the British survey thip Chaltenger, which bears a party of
explorers on a nine-month
trip to chart the Labrador
coast, looks like a foreshortened cannon. The device, shown in action
at left, in known as a hydrographic camera
and will aid in mapping rocks dangerous
to navigation. A long-range lens permits

and will aid in mapping rocks dangerous to navigation. A long-range lens permits the camera to be sighted against distant landmarks. Photographs will be made while the survey is in progress, and possibility of error in the surveyors' observations is removed by checking with the resulting pictures. The maps made in this manner are expected to be more nearly accurate than any previously made

NEW SCRAPBOOK CAN'T BULGE

Curpines pasted in a scrapbook, recently put upon the market by an eastern manufacturer, do not make it bulge. Every other page is perforated so that it may be torn out as the preceding page is pasted up, as shown in the photograph at right. This compensates for the thickness of the clippings and permits the filled volume to be flat, thus improving its appearance and adding to the ease with which it is handled.



Blimp Carries Vertical Antenna for Radio Broadcast

TRAILING from the bettem of a baby bumo 1 500 feet in the air, a 500-foot untenna recently sent out experimental broadcasts near Pittsburgh, Pa. Engineers of Station KDKA, the proper radio station that first broadcast popular programs in America, recently conducted the tests to determine the effect of a long-sending nerial operating vertically to the earth systead of parallel to it, as in the case with conventional broadcasting equipment. Programs sent out from such aerials, it has been suggested, would reach receivers more clearly and with less interference. If the tests are successful, further experiments will be made with a larger balloon at a higher altitude. In the first trials, the asuminum guy wire that served to lether the bump was also used to convey the program to the an-tenns. The photograph shows the blimp about to be launched.



STUDY FISH WITH SUBMARINE SLEDGE

To AID in surveying the plant and animal life of Lake Constance, on the German-Swiss horder, scientists have devised a contrivance known as a submarine sledge. Trailed on g wire beneath a faunch,

the sledge scrapes along the bottom on ski-like runners and collects specimens in a net. It is drawn up when full, and the catch is spread out for study. The survey will help increase fish in the lake.



Submaring aledge, on top of the survey famuch that tows it, is being made seady for submergence

VEST POCKET THICKNESS GAGE

So compact it may be tacked away readily in a vert pocket, a new gage makes the measurement of small thicknesses as easy as telling time by a watch. The jaws are opened by a wheel beneath the index finger, and close automatically over the object to be measured when the wheel is released, as shown in photo at right. A revolving pointer stops at a point on the dial indicating, in thousandths of an inch, the thickness of the material being measured.

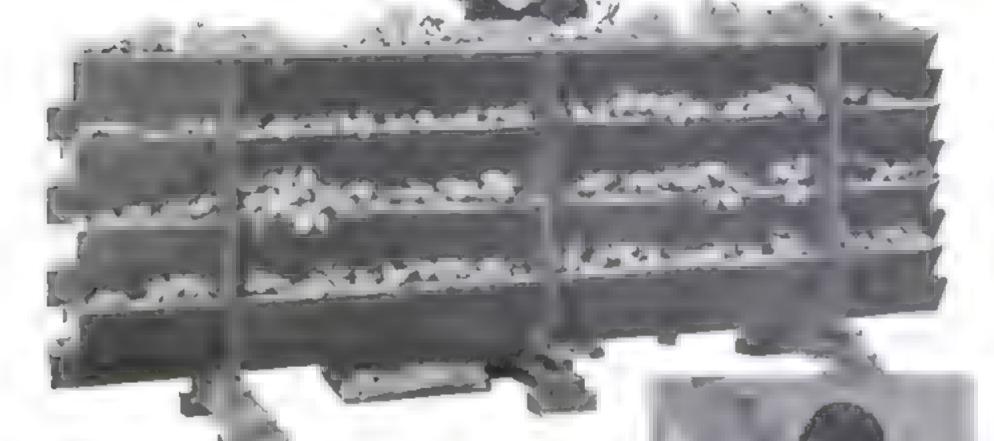




UNKNOWN MAYAN ARTIST CARVED BIG MONUMENT

Four centuries or more ago, a Mayan sculptor in Guatemala laid down his tools and surveyed a stone monument he had just completed. Twice as tall as a man, it depicted a Buddha-like figure seated in a niche. Illustrated above, this monument, and other rare treasures of early Mayan culture, have just been uncarthed and forwarded to the University of Pennsylvanta Museum at Philadelphia, Pa. Descendants of the Mayas are numerous today in Guatemala, but the lore of their ancient craftsmen is virtually lost.





By Walter E. Burton

LANT wisteds and inventors have succeeded in reducing the size of gardens to a point where products formerly requiring an acre of two of space, can be raised in the back yard, or even induors.

Several paths have been followed in reducing garden size without lowering the yield. At the moment, some of these have not been extended far beyond the experimental stage, but they give indications of great possibilities in the near future. Some need only general adoption to make them successful in a big way.

A Miami, Fla., inventor s idea of a vest-pocket garden takes the form of a senes of patented wood troughs into which is built an arrigation and fertilizing system. Combining watering and fertilizing operations, without waste, makes his method particularly desirable.

The inventor, George Leon White, claims a 1,500 percent gain in space. In other words, he can raise on one acre crops normally requiring fifteen acres.

The sample trough system shown in the photographs can be expanded to cover as much ground an desired. The unit measures six feet long, one foot wide, and about three and one-half feet high. It contains 125 strawberry plants, thriving in twenty-four square feet of soil. This concentrated garden, consisting of one trough above the artest, was invented in Plunds where it is in use. The plants are watered and feet had by the same system. The arrangement into the the tame amount of and ight for each plant no matter what trough it a in

Each of the troughs has a false bottom that, along the intersection of the two adepteces, helps form a narrow canal through which fertilizer-laden water can run. The water is poured into a compartment at one end of the top trough. Thence it right to the other end of the trough, spills through an overflow tube into the second trough, continues to the opposite end, and into the next trough and so on until the plants in every trough are watered

This continues until excess water finally flows into a container from which it can be dumped back into the top trough. In this way, none of the fertilizing material is lost. The water, as it flows along, comes into contact with the soil, which soaks it up and makes it available to the plant roots. The unit shown has been designed for use in sunrooms, on poeches, and in yards.

The inventor, by making plant food directly available to the roots, has speeded up the growing process, in addition to gaining a saving in space. His trough

In a compact box garden, like the one pictured here, vegetables are spreated for winter mu-

units can be built to any beight. A large installation can be watered by a windmill and tank arrangement.

Almost any plant, if not to big, can be grown in the troughs. This includes onnins, radishes, strawherries, celery, beets, turnips, and some varieties of beans. The troughs can be arranged so that plants in both sides receive the same amount of similable

The multiple-trough idea is a refinement of the old strawberry barrel or carthenware pot. If holes, an inch or so in diameter, are bored at evenly-spaced points around the oider of a barrel, and the barrel filled with earth, strawberry plants, and various other garden products, can be grown successfully. The barrel can be watered by mesus of a funnel fitted into the top. A group of such barrels provides a comparatively large growing area on a limited amount of ground.

Experiments are being conducted with concrete harrels or cylinders several feet high. These cylinders have holes over the curved surfaces, through which plants grow. Water can be introduced at the

top of the cylinders.

Widespread interest has been created by the wonders worked with concentrated plant food of which certain plant pills are one form. Such food makes possible the ultimate in garden compression,

A Carlornia scientist has developed a chemical preparation which, when carried in solution in water, makes it possible to raise cabbages, celery, beans, and other garden products without the use of soil. The vegetables are grown in shallow troughs, sawdast and excelsion being used to hold them in position. So great is the concentration achieved that plants thrive when crowded so closely that they touch each other. A plant can be moved from one trough to another without disturbing its growth

Other tricks of plant magic have been performed by Dr. J. T. Charleson, industrial chemist. Dr. Charleson has succeded, by using a special preparation, in doubling fruit yield and trebling the production of flowers on a single plant. In addition to this two- or three-fold gain, his plant food, which is sociable in water, can be used in troughs or any other arrangement, for booking growing manter.

arrangement for holding growing points.
Investigations made by universities and commercial establishments, Dr. Charleson points out, have indicated that there must be perfect coordination of

chemical elements in make a plant behave properly. In addition to the elements contained in ordinary fertilizers, there must be restain activators, or substances that act more as stimulants than as foods. Among the necessites for mammom yield of fruit or flower are phosphorus, potassium, nitrogen, boron, and manganese. They must be properly blended, or the plant will suffer

Dr. Charleson's plant food takes a granulated form that can be dissolved in water, one quart making fifteen quarts of stock solution which is then diluted five to one before being applied with a sprinkling can. He perfected it primarily for use with water plants, but tests have shown that it is equally useful for vegetables, rose bushes, rock garden plants, and the like. A gallon of the stock solution is enough for seventy-five rose bushes, or 1.000 square feet of garden



These tropics water liles blooming in a northern of mace, show how plants respond when given prepared food as shown in photo

By means of the plant food, he has made water hace and other plants bloom out of their usual season, and has produced flowers on aquatic plants that bluom so infrequently as to make the occasion a noteworthy event. In addition, the individual flowers generally are larger than normal. The inventer can, by varying the composition of his food, preduce almost any desired effect, such as a plant that is al. foliage and no flower. In fact, this is what ordinary fertilizers are inclined to do in many

cases, according to Dr. Charleson. The U.S. Department of Agriculture recommends that an indoor sprout garden be maintained for providing vitamin-containing food during winter months when fresh garden vegetables are scarce. Nothing could be simpler or more compact than such a garden. The seeds, beans for exam-ple, are placed in a layer between several thicknesses of cheesecipth which is kept moist. Or the seeds can be spread on a plate and kept covered with damp cloth. In addition to beans, the various cereal grains, like corn and oats, can be sprouted. The products of a sprout garden are cooked as greens, there being little or no waste because roots and all are used.

The Department of Agriculture has done extensive research work in connection with the effect of daylight on growing plants. It has been found possible to change the flowering or fruiting period of many plants by prolonging or (Continued on page 96)



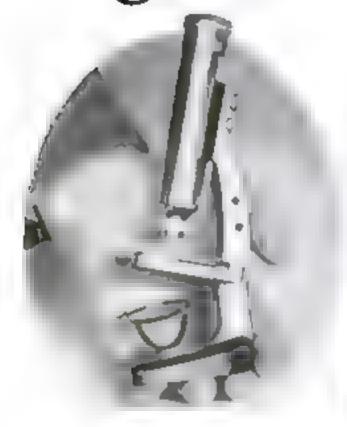


In watering and fertilizing plants, grown in the trough garden abown on the opposite page, the mature is poured into a tank, above and drains to each trough in turn as as abown at the right



Hunting Water Life

MAKING A NET TO SNARE ANIMALS AND OR SEA WATER—HOW TO STUDY THEM



This new baby milcroscope is intended for ameteurs. It magnifies up to 350 times

By Borden Hall

NE is never even durily conscious of the teeming life in the world that is crushed under one's feet or that swims and swirls through the depths of a pond until one views it through the lens of a microscope capable of multiplying images 300 times or less.

The beginner with the microscope is so appalled at the multitude and variety of siving and non-living things that may be brought to the stage of his instrument that often he is unable to decide where to begin his investigation. During the winter time we have the crystals of salt, bread, most, lice from plants, leaves, coal, hair, paper, bits of vegetables, and a bost of other common household objects that offer unending sources of pleasure and instruction.

In the summer nature offers a new world to explore, In former articles mention was made of the multitudinous forms of life to be found in pools of stagmant water. The subject was barely touched upon, however, and now we shall tell how specimens may be gathered from them and describe the new equipment we will need.

First, the amateur microscopist must learn how to pick out the jungles and the open yeldt in which to do his hunting. An ordinary mud puddle that has been standing in the warm run for several days is a likely hunting ground, especially if it lies in a wind-swept spot to which pollen and other life-bearing particles have been borne. The running brook or the lazy river or creek also will yield specimens well worth study. But the best place of all is



A one I hand less is used to examine hits of underwater regetation in skatch of spectmens to be viewed later in the microscope

a stagnant pool, where you can find a larger number of curious specimens of animal and vegetable life than in any other spot accessible to those laving inland

A FEW months ago, I suggested that we hunt microscope specimens with an ordinary, wide-mouthed bottle tied to the end of a string and dragged along the bottom of a pond. The surface of the bottom contains the most interesting specimens, especially in pools and ponds that are covered with green scum. Although the bottle makes a good hunting tool, a far more efficient instrument is the little net pertured on the opposite page. This is made of muslin with a small pill bottle attached to the bottom by a heavy rubber band. When this net is swept through the water and brought to the surface the fabric will imprison the specimens and they will be washed into the active yial by the movement of the water

Those who live near the seashore have available a theater of wonders that in many ways rivals the stangant pool in the country. For instance, wondrous latte specks of life called foraminifera will often be found in the ripples of sand left by the tide. These are small shells of single-celled animals and they assume a wide variety of forms. Many forms of life also are attached to rocks and weeds that grow in sea water. If we take a few hits of seaweed home, making sure to keep them in sea water on the way, we shall find they contain a number of interesting objects; tiny creatures, for example, that thrust forth little tentacles to entangle other minute forms of life.

NO CASUAL examination of this kind, however, is adequate, for if the scene is to be enjoyed in full, we must develop a special method. The seaweed must be held in a trough or cell filled with sea water and viewed with a low-powered objective (the lens at the bottom of the nucroscope tube,) From the accompanying photograph, you can see how easily this useful little water cell may be made. It is not only valuable for peering at the strange life that fastens itself to seaweed but also for examining other specimens that live on the various forms of vegetation in rank ponds and pools.

Obviously it would be too much trouble to run down to the seashore every time



Before drying a specimen you wish to study, it is placed in a test tube and washed in alcohol being cleaned by a brisk shaking

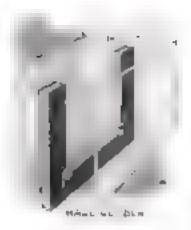


A flat specimen sometimes can be examined more cause if it is placed between two slip grantes that have been thoroughly weshed

YOUR Microscope

PLANTS FROM PONDS IN TINY WATER CELL





WATER CELL FOR SEA LIFE

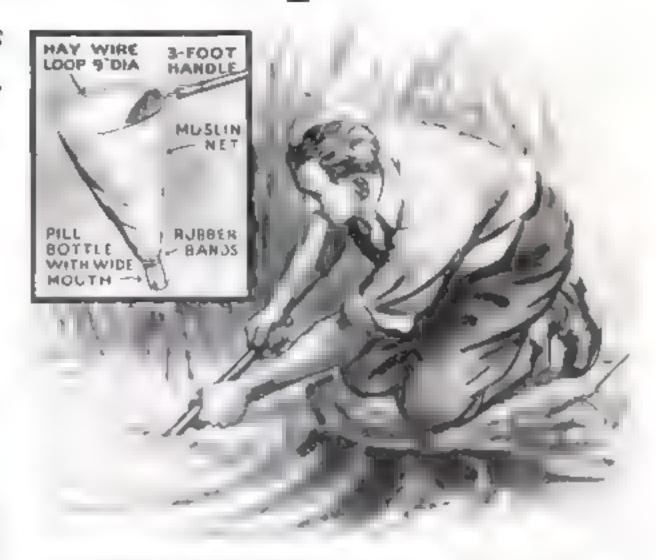
A watercels, made of two grane and a statement together as shown an drawing at sell affords a convenient way to place aveng sea aparament under a manual sell-secope

we wish to examine specimens or make new collections. To get around this problem, we establish a miniature sea right in our own homes. It can be done for a few pennies. We simply buy a small aquatium, provide it with sand, and fill it with sea water, being sure to odd sea plants to bring about agration of the water so that our specimens can live in it. In a short time, we can have a teeming community of many sorts of sea attimats.

WHILE we are considering sea life, let us not forget the stunning varieties of colors and tints that are provided by fish scales of various kinds. The specimen chosen must be small and thin so that it will be translucent. These scales are easily mounted. Transparent parts of cray fish crabs, and other crustaceans ofer benutiful studies in animal structure

We must also provide a permanent home for our specimens of poud life. To do this we arrange a fresh-water aquarium into which plant life must go to supply the needed, life-giving oxygen, Unless the water has a certain amount of oxygen dissolved in it, our specimens soon will die. It is easy to place subaqueous plants in some mid in the bottom of the aquarium, pressing their roots in and then pouring the water over them.

Peering into pend water, we find those interesting, threadlike formations of vegetable matter called algae. To discover them, we use a microscope slide with a



The inset drawing shows how a hunting net is made easily and cheeply. When fitted with a three-foot handle, it can be used, so the illustration suggests, in gathering good life

sight depression ground in it to hold water. When we find a specimen, we transfer it to a flat glass and use a more powerful objective. This transfer is made to facilitate examination with the more powerful glass. It has been noted previously that the higher the power of the objective used, the closer we get to the object. Algae are like beautiful strings of beads, the beads being vegetable cells such as those that go to make up the entire plant world. Here, however, nature, for some strange reason, has strung the cells out end to end.

Botanuts classify this strange life as Zygnema and Spirogyra. The latter branch of the family is the more interesting. It is plentiful in alower streams, hanging from the stems of weeds in long streamers. In stagnant pools, it grows by itself in scummy masses. Each cell of this plant has its bright green spiral chloroplast, a form of chlorophyl which is the substance that gives plants their green rolor and their ability to make sugar from water and carbon dioxide through a process called photosynthesis.

A SPECIMEN is stained with a weak solution of iodine. In an earlier article, I told how certain dyes are used to color specimens so that their less colorful portions will be more easily seen. When this tiny plant is treated with iodine, you can see in each cell the nucleus, the nucleolus, and the protoplasm as yellow masses

No thrill is greater to the microscopist than that of witnessing the mysterious process of creation. It is only through the microscope that this is possible. We can see it in connection with spirogyra, Here we may see two filaments coming together. The threads unite and the filaments lose their normal appearance. Watching closely, we note further that the chloroplast loses its normal form and the cell walls are absorbed. Finally the contents of the cells of one of the threads pass into the cells of the other. In a short time, the blended contents will produce spores from which new plants will develop.

A NOTHER amazing method of reproduction is revealed by the spinning globes of Volvox Gubatur. High power is not needed to discover them for they measure about one twentieth inch in diameter. To discover them, we use a water cell, dropping the microscope to a horizontal position and slapping the cell under the stage clips in the same manner as that used for an ordinary slide. Some of the water is transferred to a slip glass with a ground depression.

At first we may not succeed in capturing the wify globator but on the second or third attempt, we shall succeed. Here is a wonder of wonders—bie that takes the form of balls within balls. Looking closely, we find that the outer ball has two lashes which function like the fins on fish in bringing about locomotion. If we are patient, we can see the outer, or mother ball, grow old, peel off, and slip away to its aquatic grave. This exposes the second layer which takes up the duties formerly discharged by (Continued on page 84)

Tricks of Firebugs

EXPOSED BY POLICE EXPERTS

By Robert E. Martin

TS engine throttled down, a black touring car swung noiselessly into the driveway of an unoccupied house on Long Island thirty miles from New York City Two men hastily entered the building caseying bundles and cans. It was three o'clock in the morning The owner was hundreds of miles away on his vacation.

Twenty minutes later, neighbors tumbled from their beds at the sound of a terrific explosion. Through its shattered windows, they saw the vacant house lighted up by a plume of yellow flame flaring half across the basement from a broken gas pipe. Two dark figures were picking themselves up from the front yard outside one of the windows. They scrambled into the touring car

In less than ten minutes, Sergean Albert V. Put, head of the Bureau Public Safety and arson expert of the Nassau County Police, was on the spot The gas had been turned off and the danger of fire was over. Inside be found gasoline-soaked rags stufied in every corner of a downstairs room. The furniture was saturated. In fact the firebugs had done their work too well

backed swiftly into the street, and raced

They had spent so much time soaking the rugs with gasoline that the fumes had formed an explosive maxture in the room. The instant the match was struck, a blast hurled the men through a window, twisted the house on its foundation, and cracked off a gas pipe near the basement floor The escaping gas caught fire, flaring like n blowtorch. But it was so low in the basement, it did not set fire to the bouse above. The giant puff of the explosion which shattered the windows, also blew out the fire in the gasoline-soaked room. Strangely enough, too much gasoline had saved the house from flames! It also preserved intact all the evidence of the plot to burn the house.

Imported in the dirt of the driveway, Pitt found the tiremarks of the arson car. They showed the front wheels had tires of different treads. Making plaster casts of the marks, he checked up on every touring car in town. Only two machines had treads that matched the imprints. One belonged to a taxi driver who proved he knew nothing of the plot. The owner of the second car was found in bed, burned and brussed. He confessed, imputating his companion and the owner of the house. Pressed for cash

Ash gare are die all

to prevent foreclosure on his score. The owner had bired the men to burn down his insured house while he was out of town. All three men were given prison are a

Arson, today, is at an all-time peak an the I mand States. America is the how of the incenduary. More fires of a superious nature occur here than in any other country in the world. Day and night, the firebug and the pockets of An team the figures, thriving the firebug and the pockets of An teams.

ditions, are burning buildings for stated fees. Their work raises the rate which everyone has to pay for fire projection

An expert took me recently that more damage is done by one incendrary fire than by a dozen ordinary ones. In arson, everything in planned to help the fire make beadway. More than half of all the firemen who lose their lives, die in flames started by the incendiary torch. A large proportion of the 10,000 people who perish annually in burning buildings owe their deaths to fiendish firebugs who burn for profit, thrill, or revenge. Fighting arson is a national problem, now complicated by the ingenious tricks and the elaborate mechanisms used.

Only a few days ago, a gang was trapped in the act of setting up a fire machine, an involved device of coils and containers, in an eastern hotel room. The arrests followed a week of day-and-night watching from a nearby church steeple after Chief Fire Marshal Thomas P Beophy, famous firebug hunter of the New York City department, had received a tip from the underworld that the torch gang intended to fire the building.

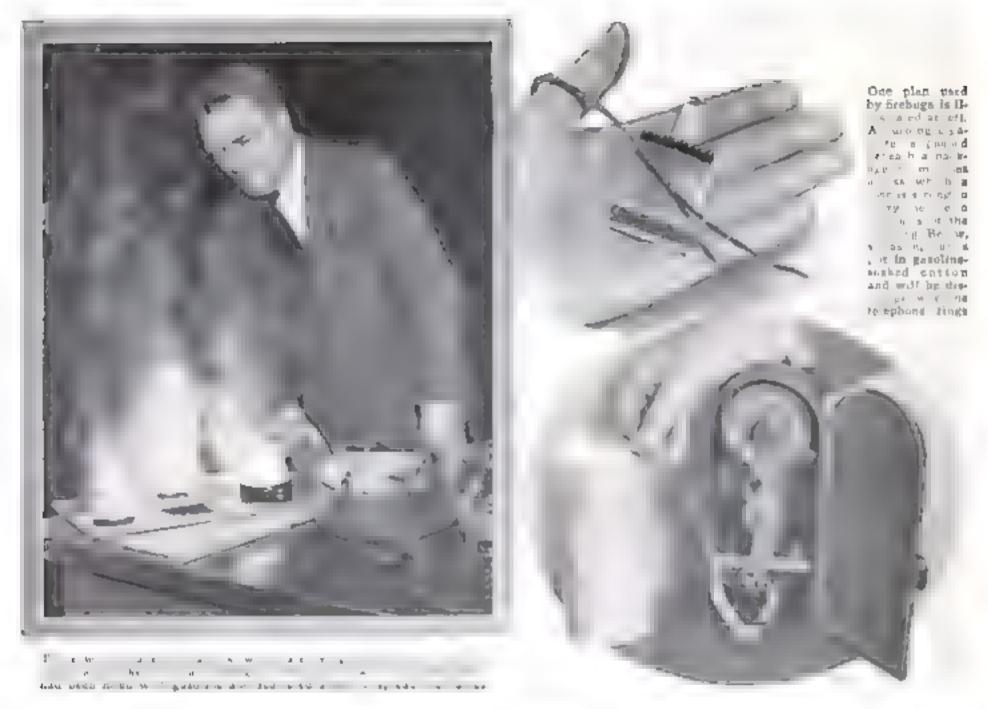


Were and blast-hg cap are attached to a doorbell so cap is discharged when the button is pushed, thus starting a fire

One of the queerest cases Brophy has had in recent years was no incendiary fire in a school for deaf mates. He had to question each of the 250 persons in the building. The questions were asked by the superintendent of the school in sign language and each child wrote the answers on the blackboard for Brophy to read.

A fire of mysterious origin recently gutted a \$40,000 home on Long Island late at night. At the time, the owner was away on a business trip and his family was in Europe, The house was heavily insured. No one was seen near the place on the day of the fire.

By a britaint bit of detective work, Sergeant Pitt uncovered evidence of an almost perfect plot to burn the building and cheat the law. When he examined the runs, he noticed something curious. Chaging to the remains of the telephone, was a short piece of wire with a bit of



Concerted Fight Made on Arson as Criminal Fires in United States Cost Over \$5,000,000 Each Year

melted copper at the end. Pitt called the local telephone exchange. He learned that a long distance call had been put through to the house on the night of the fire, some ten or fifteen minutes before the flames were noticed.

The owner had attached a wire, ending in a small blasting cap, so it would ignite a container of gasoline when the telephone rang. Then, after midnight, he had called up his own imoccupied bouse from Chicago, thus touching off the fire which practically destroyed the building. The fact that he was a thousand miles away at the time of the fire, he thought would completely eliminate him from suspicion.

In another instance, an electrical contractor reged up a similar wire and blasting cap and attached it to his doorbell. Then he sent himself a telegram from a distant city, timing it so it would arrive in the early morning hours. When the messenger pushed the button, the fire started inside. However, it was not noticed until twenty minutes later when the flames were making rapid headway

A third application of a wire and a blasting cap to the work of the firebug recently endangered the lives of forty people living in apartments above a block of stores in a west-

An electric clock of the type that automatically turns electric sums on and off, was attached to wires in a trash-filled base-

ment. The cold-blooded plotter set it to switch on the current at 1 30 a.m., ignoring steps of celluloid and a can of gasoline. In addition, he left an electric fan running to drive the flames through the cellar, bastening their work of destruction

All these carefully planned and fiendish preparations were upset by an aching tooth. At 1 30 a.m., when the clock closed the switch, a man living overhead was walking the floor with a swollen jaw. He smelled smoke as soon as the fire started. His quick alarm brought the fire department in time to check the flames before they left the basement.

Not infrequently, some strange unforeseen circumstance, like that throlding motar, will trip up an arson plot and result in extinguishing the fire in time to preserve evidence against a plotter.

One of the most curious instances of the kind occurred a few years ago in New York City. A baby, sleeping in its crib, was awakened soon after midnight by drops of hot water falling on its face from the criling. The cries of the child aroused the family of seven persons just in time for them to escape from the burning building and sound the alarm. A pyromaniae had set fire to the empty apartment above. The flames had melted a

water pipe and this water, seeping through the floor at the exact spot above the infant's head had acted as the clarm that saved their lives!

The mental disease that makes a pyromaniac set fires is still a mystery to psychology. In a number of cases, these dangerous unfortunates have been made sane and happy by being allowed to stoke prison furnaces. This satisfied their abnormal craving to be near leaping flames.

Imagine a fire department made up of pyromaniacs! That was almost the situation in one case solved by Sergeant Pitt, in a Long Island town, where the local fire department had won first prize in a competition among volunteer organizations, mysterious blases began to appear an rapid succession. In less than a year, the town had more than a hundred fires Arson was suspected, but definite clues were lacking

One night, a man troubled with insomma looked out the window and saw a sedan with two men in it drive past out of a dead-end road. A few minutes later, in the direction from which the car had come, flames shot up from an empty house. The man had seen the car and its occupants clearly enough in the mounlight to give a rough description of them. The description fitted two members of the local fire department, one an ex-captain, the other a deputy-chief

Working fifty-three hours without sleep, Pitt obtained confessions from more than thirty members of the fire department. Twenty-three indictments resulted, with fourteen defendants pleading guilty. In (Continued on page 96)

TIME TABLE OF STAR EVENTS

The sky map right, shows various positions of piecets and stars through the summer months for eral star groups that can be seen with an operagiant are indicated Reference to it will help you keep track of the racing planner from month to month



What You Can See In Starland with an OPERA GLASS

In observing the erare with a field glass of an opera-

which the planets, the moon, and the sun are spirited rivals, are constantly being run along a narrow sky track that goes completely around the heavens

Once you have learned to trace the course of these mighty racers, and how to know them at a glance, you will have endless deaght in watching their sprints from month to month and year to year

Fortunately, the summer mights this year offer a splendid opportunity to get acquainted with the big shots. Mercury Venus, Mars, Jupiter and Saturn. They will all be coursing along the part of their track visible to us during June, July, and August

Let us begin by tracing out a part of the race track, making use of the star landmarks we learned last month with the aid of our charked umbrella and the bow ruler we invented (P. S. M., June, '33, p. 42).

During the early evenings of June and July, the dipper hangs down at the left of the polestor. Its handle points up toward the senith. By prolonging its curve you find brilliant Arcturus, high in the sky. A line through the two stars in the side of the bowl next the handle, prolonged about fifty half-mach degrees westward, finds Regulus, the chief star of the group cailed Leo, the Lion. Regulus gives

you a point exactly in the middle of the sky race course. It appears in the westward sky after sunset, about sixty degrees

from Arcturus

To find another point in the track imagine Arcturus and Regulus as lying at two corners of a big right-angled from angle. At the right angle, about thirty degrees on your bow ruler southward from Arcturus and fifty degrees eastward from Regulus, you will see a bright star. This

in Spica, the wheat ear in the star group called Virgo, or the Virgin. Spica also marks a point on the path of the planets By Joining Regulus and Spica, we have surveyed a section of our celestial race track.

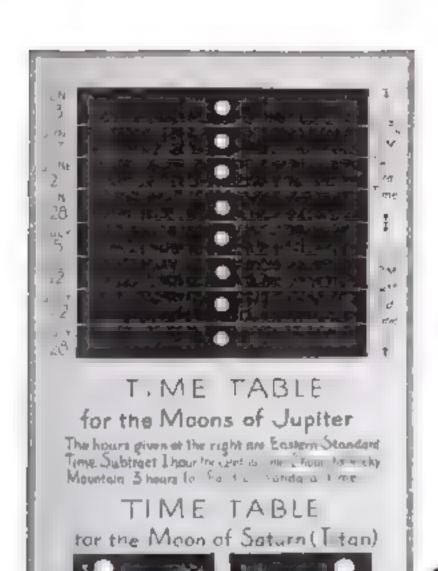
Along this line pass all the members of our solar system including the sun and moon. When you find Spica, you will see, in the part of the track extending toward Regulus, two of our sky racers right there now. They are Japater and Mars. On the evening of June 4, they are neck and neck, Jupiter is the brilliant one slightly to the northward of Mars, which you will know by his more reduish color.

If you watch these two planets through succeeding evenings of June and July you will see Mars pass Jupiter, and leave him far behind. The position of each planet is indicated on the blackboard chart at the head of this article. Note that the course of the planets along the track is always eastward.

Your observation this summer of the movements of Mari and Jupiter will be more interesting if you watch how, once each month, the swiftly racing moon overtakes and passes both planets. The moon will draw abreast of Jupiter on June 29, and will pass Mari the next night. On July 26 and 28, the moon will again race and heat these planets successively

Now let us trace the heavenly race track across the rest of the summer sky. We will then be ready to examine some of its points of interest with an opera glass and a binomial.





The line joining Regular and Space runs costword through the four additional star groups outlined on the blackboard chart Libra the Scales is inconst cooks but Scorpto, the Scorpion, is easy to recognize. It is the only star group that looks much I ke the object for which it is named. You will find it directly south at nine a'clock during the mon h of Just The pa h of the planets or ecliptic line, passes directly parth of Scorplos brightest star Antares Its reddish color explains its name which means rival of Mars You will have an opportunity to compare them when, about October 1, Mars will be approaching the star group of boorpio, and will therefore be near An-

I THE FTH

Y 2 NO

LY M H

such a program of 11 year

The remaining nummer star groups along the planets' path, Sagittarius, the Archer, and Capricornus, the Sea Goat, have no brilliant stars, but the latter is made conspicuous this year by the presence of the slow-moving planet Saturn. It requires twenty-nine and one-half years to complete the whole circuit of the track, so it remains for more than two years in each of the twelve star groups along the course

We will first turn our opera glass on Jupiter. You will know where to find him this summer from the dated positions on the biackboard chart. Through a powerful telescope, you would be able to tee the variegated belts that cross his disk. These are beyond the power of an ordinary opera glass, though a strong one will reveal one or two of Jupater's

Exciting Races in the Heavens-Faint Dots that Turn into Great Clusters of Stars-Learn How to Study Moon's Features

By GAYLORD JOHNSON

Map, left, to of the fa-

mous nebuls in Orion.

four moons when they are taxoraety situated, and when there is no moonlight to cum them.

With a field glass, or binocular, magnifying eight or piore times, you will have no difficulty in seeing all of the moons, unless they are behind the painer or so close to his side that they are fest in his glare

It you wish to observe Japuer's satellites in a serious way send to the Govemment Printing Office Washington D C, for a copy of The American

Ephemeris and Nautical Almanac for the year 1933, price \$1.75, clothbound, It gives the position of Jupiter's moons for every day in the year, together with much detailed information about the position and movements of the planets, moon, and

When you catch your first glompse of Jupiter's moons, you will be able to imagine the kick Galdeo got when he saw them for the first time in history, on January 7, 1610. His homemade telescope, through which he discovered them, was only a one-eyed opera glass, yet with it be caused a revolution in the world's aleas of the universe

Mars offers no features within the reach of a field glass, but a good one wil-

show T tan, the largest moon of Saturn You must wait, however, until you have a telescope magnifying 100 or more times before you can see in detail the other moons of Naturn and its marvelous system of rings

When you have lound the star Antores. in the Scorpion, take your opera gass and examine the region immeda-riy around it Just below and to the right of this smodering red star, you will see a nebulous speck Examined through a more powerful field glass, if is seen to be not a single star but a t ose y compacted c us-

This, by the way is a good way to proceed in all your star observations. Have an of k ra or f ele g ass with a wide field, 70 mtinued on page 64)



These three maps about the moon from the first quarter to the third and clearly indisate the leading features that are most easily observable at each time of the month

Ship's Magic Eye Pierces Fog



AUCCESSFULLY fried out in a first seamuda, a new marine instrument called a fog eye reveals the presence of objects hidden by darkness, fog, smoke or artificial smoke screens. Shipping and naval officials see revolutionary possibilities for the remarkable instrument in peace and war-Perils of codesion at sea, as a ship plows through darkness or fog, may be removed by the fog eye. On the blackest night, it is said to warn of an approaching vessel as far as fifteen miles away; to detect a menacing iceberg in time to avert a disaster and even to locate a drowning man, strug-

gling in the water, so that searchlights may esta aboard the liner Owen of Ber- be directed on him and rescuers reach him In time of war, an enemy ship, stealing through the gloom with masked lights, is spotted at once, and the sensitive eye will also warn of approaching airplanes or dangibles. The secret of the fog eye's power to see in the dark is found in a well-known scientific principle. Every object that is warmer than its succoundings emits rays of radiant heat identical with the rays that stream from the familiar household electric heater. These rays pass easily through fog. smoke and darkness. Though invisible to the eye, they may be detected by an elec-

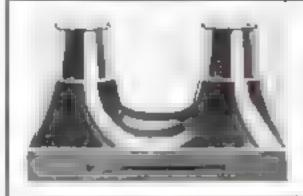
sensitivity. It is such an eye that the inventor Commander Paul H. Macneil, has built into his instrument. Sweeping the horison, it reacts to any warm body it encounters. and its amphited signal operates an alarm. as explained in the numbered legends of the accompanying drawing. Any object apprerubly colder than its surroundings, such as an (ceberg, also operates the alarm. Additional that for the fog eye on land have been proposed, among them, the spotting of forest fires before they have gained sufficient headway to do serious damage. Macoril first plans, however, to offer his invention to the U.S. Navy for use on its vessels as a defensive instrument.

Orchard Sprinkler Gets Unusual Test

To am in the design of new types of orchard sprinklers, an unusual proving ground has been established by a California engineer. A high shield, equipped with a window, permits an observer to watch the performance of a spray nozzle at close range, without getting drenched. Funnels and test tubes are set in stands at measured distances to study the distribution of the falling spray during a test. If the nearby tubes collect more water than those farther out, or vice versa, the sprayer is considered unsatisfactory. With the aid of the proving range, special types of vibrating spray

heads have been devised to give equal distribution of artificial rainfall over the entire area that is being watered.





POCKET STEREOSCOPE

Gong is the old-fashioned parlor stereoscope of a generation ago, but its counterpart, in modern guise, has just made its appearance. The new pocket-sized form of the instrument illustrated above, is as small as a pair of opera glasses and uses thirty-five-millimeter motion picture film instead of paper photographs. A shift lever causes the pictures to appear.

SHOWS VIEWS ON FILM

New Pick-Up Transfers Railway Passengers at Full Speed

Punnels, with test rubes at-

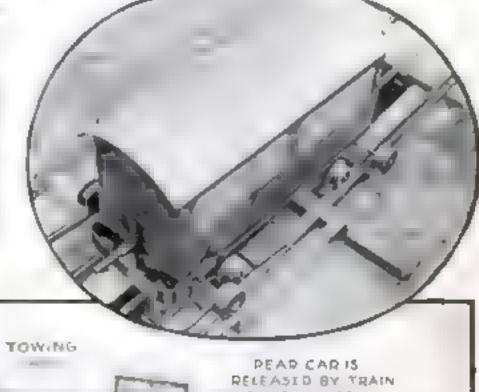
tacked, are set at measured

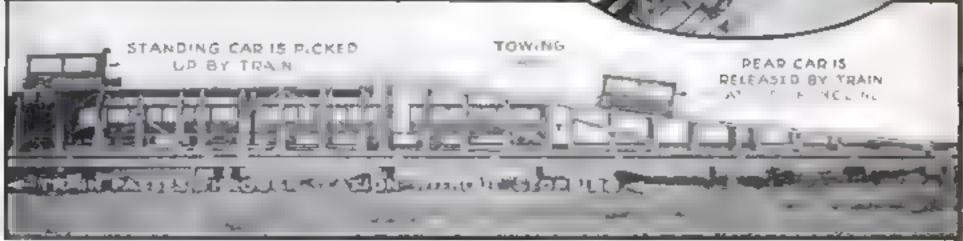
distances to test distribu-Hon of spray by an obter

Left, note protecting abield

er was it whosees through a station may ie made possible by a pick-up system recently demonstrated with models before French rastroad officials. The plancalls for the exection of inchned ramps of wide-gage track at each station. Passengers wishing to leave the train at the e at mation go to a small traver car at the rear. This can has an extra set of wide-gage wheels, and is attached to the train by a cable instead of a coupler. When the traser car strikes the ramp, it cenos the incine, while the cable is paid out from a drum. At the top, on nutomatic release uncouples the car and transfers the cable to a standing car-

with p wasting to board the train. The second car is towed door posite end it be cline to the main tracks and joins the train when the call-k ts recled in, Shockabsorbing devices minimize the jolt of taking on the sudden load. Passage from the trailer to the masection of the train is made through an ordmary vestibule



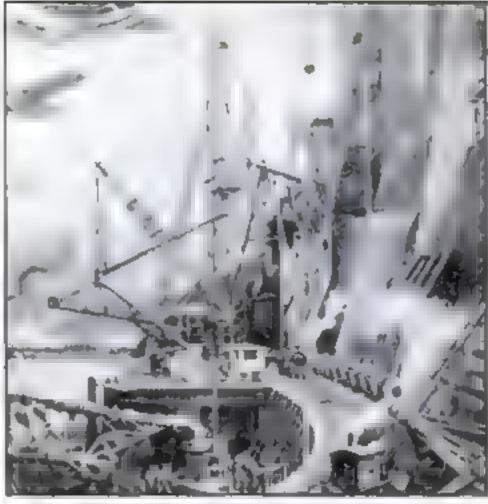


Dummy passengers were picked up and unloaded without stopping an express train in a recent demonstration with these model cars. Photo shows model train about to uncouple its trailer car and take on one standing no ramp. In oval, close-up above how trailer engages camp with entry wheels

Big Dam to Water Sahara

TURNING the Sahara Desert into blossoming farm land, with water drained from the Mediterranean Sea, is the ambitious project for which Hermann Sorgel, German engineer, seeks international support, He proposes to dam the Strait of Gibraltar, and then cut a canal to flood portions of the Sahara below sea level, Evaporation from the inland lake thus formed would produce rain clouds and water a vast area, he maintains. By products of the scheme would be hydroelectric power and new land reclaimed from the Mediterranean.

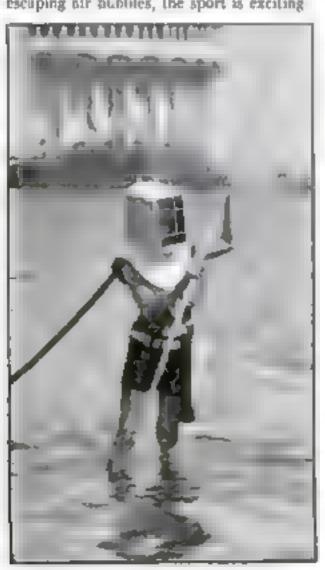




Above, artist a conception of the dam proposed for the Strait of Gibraltax and intended to be p flood low parts of the Sabara Desert. At july Herman Sorgel, oraginator of achema, with model of Med tetrangen

CALIFORNIA FISHERMEN WEAR DIVING HELMET

Frence in a diving out is the latest sport innovation at Catalina Island, Calif Equipped with a diving belinet, and weighted down with a lead belt and shoes of the same beavy metal, the submarine fisherman walks out from shore as shown below. His trailing air hose is attached to a compressor on shore, behind him. He carries a long-handled, three-pronged spear with which to kd, his catch—if he can As fish mostly are attracted by the escuping air hubbles, the sport is exciting

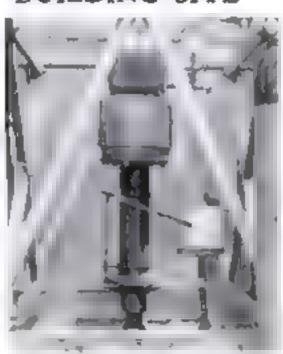




WEIGHTS TEST NEW BUILDING SITE

Serriero foundations, that cause unsightly cracks in the walls and ceiling of a building are forestalled by an unusual testing device Invented by R. V. LaBarre, an engineer, Los Angeles, Cabi., it determines how much load a plot can safely support before the building is creeted.

At the chosen site, a steel column with a wide base is so in a hole thirdy feet deep for the top of this beam is then added the weight of two wooden boxes filled with fifty tons of earth (illustrated in oval above). The settling of the soil under the beavy load is indicated by a pen moving across a revolving chart, as shown in the photograph at right from this chart, the fitness of the site is passed upon. An ingenious form of jack, consisting of a cylinder filled with compressed natiogen gas, transfers the weight of the boxes of earth to and from the column



New Rotor Ship Sails in Lightest Wind



Laurence J Lash aeroneur cut ang neer. disp ays a working model of his rotor ship. which will be eab bited at Chicago Fair

DOKING like whirling puriboants strange new rotors will furnish the power on a boat now nearing completion at Chicago, Laurence J. Lesh, proneer aeronautical engineer, is designer of the craft

Unlike the Flettner rotor ship, which attracted wide attention a few years ago. his boat will depend entirely upon the wind for propulsion. No engines will be required to keep the rotors turning, as was the case with the high "chimneys" of the German craft. Once the pointed, vertical wings of the Lesh boot begin spinning they keep on until the wind dies down or

a T B. WE's VE TE FER C B L C .74 OR CAN BE 55 45 CROPMARY A SWHEN B X Seme LOCKED N JES = E POSITION Diagram above explains the overation and pt no ples of refor busts. Left Leib a mode in action proved it will hall the brakes are ambled

start them whirling and move the ship. For more than a year, Lesh has been experimenting with miniature rotor ships in the model boat basin in Jackson Park besider conducting various wind-tunnel tests. His researches have shown that the spinning wings of his models will pull the

The lightest of breezes

testa bave shown, will

boots directly into the teeth of the wind and that they will give almost four times the propelling power of ordinary sails They spun equally well in either direction, an improvement on the S-shaped

roters of the Fannish invenfor, Savonius, which require a complicated mechanism to

FORCE . MAGNUS FLETTNER

FORCE

shift the halves of the rotor when a shift heads about and takes a new course in the opposite direction.

The full-sized experimental boat, nearing completion, will be used to try out rotors of various sizes and constructions Different cotors of the same mae will be covered with canvas, plywood, and polshed duralumin and tested to discover which material is best suited for the work To drive a seventy-foot cabin cruiser Lesh says, three rotors would be needed



RACK HELPS IN PAPERING CEILING

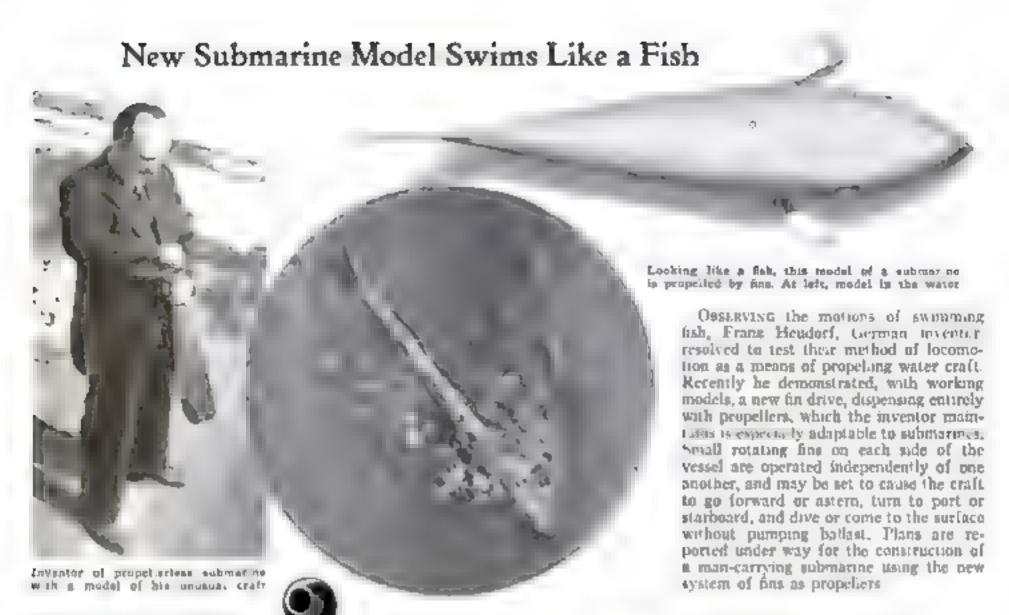
PAPERING ceilings can now be done easily by the layman, it is claimed, with the aid of a hanger recently introduced. It consists of an adjustable each that aligns and holds the paper, gives or takes up the

slack as needed, and leaves the operator's hands free. The hanger can be adjusted for height and for the width and weigh of paper. As shown in photo above, the rack can be used on a narrow scaffold

FIVE BLADED RAZOR CUTS SHAVING TIME

Five blades, enstead of one, are used in a new type of safety rasor introduced by a French inventor. One stroke of the ranor across the face is said to remove every trace of bair in its path. The speed of the resulting shave it enhanced by the fact that the razor need not be taken apart after shaving. It is merely rinsed under the faucet and screwed, head down, in its special case. The blades require no sharpening, according to the maker, and will give good service indefinitely,



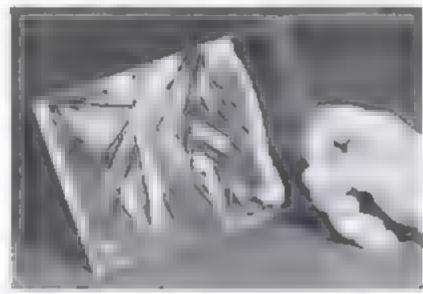


TIRE VALVE TESTER FITS VEST POCKET

LEAKS in tire valves are quickly detected with the aid of a new pocket tester, illustrated at right. The flexible rubber socket fits over a valve stem, in king an air-tight sea. If any air s caping from the valve, bubbles appear at once in a glass cylinder containing water. The device eliminates the uncertainty of the familiar wet-finger test. It is provided with a holding c ip and can he carried conveniently in the vest pocket, exactly like a pencil, and is thus a ways instantly at hand when an annoying slow leak, sometimes bard to find, makes it necessary to use it

A NEW point, that forms its own designs, is easily applied by an Inexperienced person to lamp shades, vases, electric push-button plates. and other household objects. Decorative lines and potterns appear as if by magic during the drying by a process simbut to erystanization of certain galls from an evaporated solution, bix

different colors, besides black and white, are available. The paint may be applied to metal, glass, or cellophane.



PAINT FORMS DESIGNS WHILE DRYING

This paint applied to glass or earthenware, forme its own deeigh while it is drying. No experience is needed to use it



NEW BOWLING ALLEY HAS NO PIN BOYS

ELECTRICITY does all the work of pin boys in a new type of bowling alley that eliminates delays in play, Duck pins are used, suspended on chains and held in place by steel sents with triggers. When a hall knocks a pin off its base, it is automatically lifted out of the way. The bads are returned automatically by an iron rocker-arm that picks them up and deposits them in the inclined side gutter. Then, merely by pressing a foot lever, the player sets all the pins up again, Power for the all-electric alley is suppued by a one-half borsepower motor. The photograph shows one of the new alleys in use with the mechanical pin boys removing and setting up the pins.

COMPLETE RADIO SET PUT IN HEADPHONES

INVENTIVE ingenuity has succeeded recently in building a complete radio set into a pair of headphones. No batteries are required, since the set uses a crystal detector, which is adjusted by manipulating a small knob on one of the receivers, or shown above. To tune in any station the user has merely to turn a larger knob at the back of the same receiver, operating a diminutive tuning condenser. The set will operate successfully wherever the cords of the set may be plugged into a convenient aerial and necessary ground connections are possible

BIG CROSSBOW HURLS MAN FIFTY FEET

Somersaulting fifty feet through the air from a grant crossbow, a California daredevil recently introduced a new circus thrill. Billed as a human arrow, he takes his place in a small metal cradle and braces himself for the shock of start

ing. At a given signal, an assistant trips a trigger and the acrobat is burled into the air and lands in a net fifty feet away. The cradle is driven by a coil-spring mechanism said to exert a driving force of more than 20,000 pounds.





Hurled by a powerful spring from the cradle of this crossbow, the man files filey feet

COMPRESSED AIR NOW STEERS AUTO





ALUMINUM FOIL SUPPORTS SWING

To be Monstrate the strength of aluminum foil, engineers recently arranged the unusual test pictured above. Three of the thin metal abeets, each about six ten-thousandths of an inch thick, formed a support for a swing in which a young woman sat. The improvised swing, calculations showed, could support 200 pounds.

GRAIN DUST EXPLOSIONS

Inside the can, right is a lighted candle. Through the tube, constantly is blown ato the caudie of time which appleded it as the cover of the can will be blown off to this experiment. The destructive explosions in grain clovators are dupt extend on a tiny scale. At extreme right drawing shows arrangement of apparatus for experiment of apparatus for experiments.



Giant Explosions

REPRODUCED IN MINIATURE

by Home Chemists



To prove that every burning candle is a ges plant, achine a tube over the flame, as is shown above. In a about time gas, excepting from the tube, can be lighted.

ARMLESS, miniature explosions make experimenting with combustibles a thrilling, yet safe, amusement for the amateur chemist. With inexpensive homemade apporatus, he can duplicate the explosions in a gasoline motor and amuse his friends by burning air

When we say a substance burns we imply that it combines with oxygen to produce heat and sometimes light Hydrogen and carbon, as well as many other substances containing these two elements, display this property A candle, for instance, is made of paraffin, a combination of carbon and hydrogen. When the wick is lighted, the paraffin melts and produces bydro-carbon gases, which decompose to

form other inflammable gases and carbon.

If a cold object is held in a candle's yellow flame, a black coating will be deposited on its surface, proving that free carbon is given off. That burnable gases are present can be shown by inserting the end of a short metal or glass tube in the flame and igniting the unburned gases issuing from its outer end.

In the case of the candle, the hydrocarbon gases unite slowly with the oxygen of the air. If by some means this action is speeded up, an explosion results. It is this speeded-up type of hydro-carbon combustion that is used to drive the purious in an automobile motor

A miniature explosion of this type can be carried out sately in the home laboratory by making use of the hydro-carbon vapors given off by a few drops of gasoline. First select a suitable tin can having a friction top that does not fit ton tightly. Make a half inch hole in one side near the top piace two or three drops of gasoline in the can, and fit the friction top

With the ran supported on a stand, place a lighted candle near the hole and heat the bottom or side of the can with a was or alcohol flame. As the can is bested the inflammable liquid will vaporize, mix with the inclosed air, and leak out the half-inch hole in the side of the can. When the mixture contains just the right amounts of air and hydro-carbon vapors, it will be ignited by the candle and an explosion will follow The cover will be reptly blown from the can or the receptable will high sideways away from the candle Being small and in an unconfined

vessel, the explosion will be quite harmless if directions are carefully followed.

In fact, any of the ministure explosion experiments to be described can safely be performed in the living room, provided you use reasonable care.

News items telling of violent explosions that blow up grain elevators always strike a note of mystery. Grain and explosions somehow do not seem related. However, by using comstarch, the amateur chemist can create such an explosion and study the strange phenomena caused by the instantaneous burning of grain dust.

To do this, punch a small hole in the bottom of a half-gallon tin can. A funnel containing a teaspoonful of cornstarch is then placed in the hole from the inside so its stem extends below the can. Connect a short length of rubber tube to the outer end of the funnel, place a lighted candle in the can, and fit the friction cover in place. As before, the cover should not be a tight fit

Place the free end of the rubber tube in your mouth and blow suddenly into the hose. The cornstarch will be scattered into the air inclosed in the can and, aided by the heat from the candle flame, will unite rapidly with the oxygen. In most cases, the resulting explosion will blow the cover from the can and raise it a haif foot in the air.

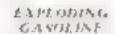
Flour, charcoal, lycopodium, fine coal dust, and other common combustibles can be made to ignite and explode in the same way. Better results often can be obtained if the substance is first heated to remove any moisture that may be present

How Blasts of Grain Dust or of Gasoline Vapor

Are Caused in Your Laboratory—Tests With

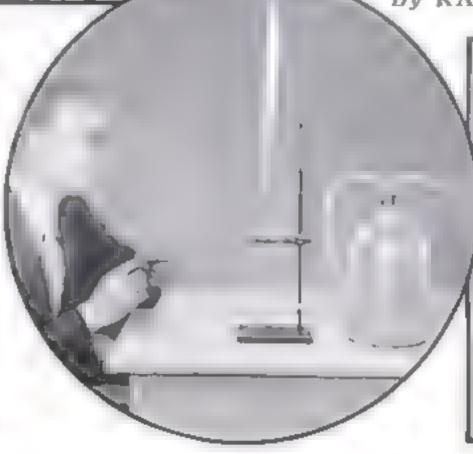
Which to Prove a Burning Candle Is a Gas Plant

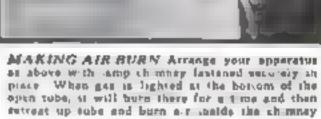
By RAYMOND B. WAILES



Two or three drops of the control of

CAN HEAR





Although these experiments tend to show that all substances containing carbon or hydrogen are inflammable or exposive, this is not the case. Carbon tetrachioride, for instance, is a combination of carbon and chloring used for extinguishing fires and, as a cleaning fluid that will not burn, it is used in place of gasoline and benzing, Instead of exploding or burning, carbon tetrachloride decomposes when held near a flame.

To illustrate this, mousten a small wad of cotton with the liquid and hold it around the base of an oil lamp or lantern. The vapors will be decomposed and the carbon liberated will condense on the glass globe as a black cost ug.

If the moistened cotton is held at the air ports in the base of a Bansen burner and a copper wire is held in the normaly blue flame, the flame will change to a bluish green. This color change is caused by the chlorine given off when the carbon tetrachloride decomposes. The chlorine unites with the copper and then breaks down again to form copper vapor and chlorine gas. If a cold white surface such as the bowl of a bubble pipe, is held in the bluish-green flame, a visible coating of the copper will be deposited on it.

One would hardly expect to burn air Yet, with a simple arrangement of parts consisting of a samp charmey some plaster board a few pieces of plass tubing and several feet of rubber bose, the home chemist can do just this.

Support the glass lamp chimney on a sheet of plaster board fitted with two glass or metal tubes, one fourth inch in diameter. The tubes, about three inches long, should extend up into the chimney about half their length. When the chimney

has been wired or otherwise fixed in position to prevent it from toppling over, place over the chimney top a sheet of plaster board having

a half-inch hole in its center as is shown. Place a finger over the hole in the plaster board capping the chimney and turn on the gas. After a half minute, light the gas issuing from the free tube under the chimney, turn the gas low, and remove your finger from the upper hole.

At first, the gas will burn outside the lower tube. When the finger is removed, however, the flame will travel up the inside of the tube and appear at the end of the tube inside the chimney. With the bottom end of this tube open to the air the flame in reality is caused by the air burning in an atmosphere of gas. This type of action is called a "rec procal combustion." Since combustion is the combination of a flanunable substance with oxigen is the will burn in an atmosphere of the other.

This same arrangement of parts can be used to show in a rather unique way, that gas becomes explosive only when mixed with oxygen. After completely ventilating the chimney to remove all the gas place a finger over the outer end of the free air take and allow only pure gas to enter he chimney. After about a half minute, light the gas assuing from the hole in the plaster board chimney cover. Then shut off the gas and remove your finger from the bottom tube.

The gas in the channey will rise and continue to burn at the hole in the plaster board. Since air also will enter the chimney through the opened bottom hole the chimney soon contains a mixture of gas and air. When this mixture is composed of just the right proportions of each, the

flame burning outside will suddenly dark into the chimney and cause the air-gas mixture to explode with a barmesa swish.

In most cases, the explosion will not be violent enough to blow the loose plaster board cap from the chimney. However, as a precaution, do not under any condition fasten the plaster board firmly in place.

A novel magic flame, more sensitive to sounds than our own ears, forms one of the most amusing experiments the home chemist can perform,

A gallon or half-gallon bottle serves nicely for this experiment. Fit it with a cork supplied with two short glass tubes and connect the gas supply to one and a rubber bose fitted with the glass portion of a medicine dropper to the other. After waiting for the air to be driven out of the system light the gas at the tip of the medicine dropper. With the gas turned an full, the flame will roar,

Then place a surable pinch clamp over the rubber tabe leading to the inlet of the botile and throttle the gas gradually until the flame burns less violently and ceases to roar In his condition the flame will be sensitive to the faintest vibrations.

Every noise will cause the flame to duck. Even the slight scrotching noise mode when striking a match will cause the sensitive flame to dart. By experimenting you will find that high-pitched sounds cause the flame to shorten or dodge more than low notes. A flame of this type is so sensitive that it responds to vibrations so rapid (high-pitched) that they cannot be heard by the human ear

Full Orchestra on Empty Stage

RCHESTRAL music such as never before had been justing heard paured from the apparently empty stage of Constitution Hall. Washington D. C., a few nights ago when Dr Leopold Stokowski, conductor of the Philadelphia Symphony Orchestra, demonstrated be-fore the National Academy of Sciences, a new electrical system of musical reproduction and transmission developed by engineers of the Hell Telephone Labora-

The source of the music was the stage of the Academy of Music in Philadelphia 150 mites away. There the hundred musitians of the Philadesphia Symphony Orchestra played a program of Handard orchestral numbers. In front of the Philadelphia stage stood three sensitive microphones, one in the center and one at each side. Each was connected segurately by telephone lines with a loudspeaker that stand behind a sound-porous curtain on the stage in Washington

In the rear of Constitution Hall and Dr. Stokowsky, before him a small oblong box not unlike a midget radio receiver, with a front panel equipped with three dials and a pair of switches. Monipulating these devices, the conductor controlled the music of the far-away prchesirs, bushing the sounds issuing from the loudspeakers until they were barely audible, and then making them swell to twenty times the volume produced by the actual orchestra

Conductor, 150 Miles from Musicians, Controls Expression with Master Key M EROPHONE IS CONNECTED TO CF & Tr F SPESSED IN CONVENIENCE P. G. J & F EA E N WASHING YON March to the NEFDT - AT N - A - A - A - A - A AND TRANS MITTED OVER FILEPHONE LINES Audible Frequency Range of Musical Instruments and Familiar Sounds BA H M SHAM M M IS CVMBA, S CENTED MICEORIUME PICKS JP SOUND FOR MAIN SPEAKER By Mark to Sec. 11,171 trawing above shows W ME IS course of the music as ovebrared prays by THUMPY T there is and EXPONENT AL HORN phones which savry the tones to out E F SEMANNE NASH LARINET LAN NET SOPRAND SAE speakers 50 m es APPOWS SHOW PATH Barraw and AWAY OF SOUND operations waste sta-OBOF and take tenu formus m to conductor regulate their output MALE SPEECH FEMALE SPEECH FD07516P3

> At no time was there any auggestion of discortion, nor any bint, in the quality of the music, of the electrical transfer it had undergone. For the new apparatus—microphones, amplifiers, electrical filters, transmission lines, and loudspeakers-reproduces with absolute fidelity all sounds that the normal human ear is capable of hearing

THIOUTHCY CYCLES PEP SECOND

500L

Moreover the local on of the microphones in reference to the source of sound and the placing of each loudspeaker in a position that corresponds with that of the particular microphone with which it as connected brings about an effect that the Bell Telephone engineers call "auditory perspective," that is, an illusion that causes the listener to seem to bear a specific sound from the point at which it originates. For example, the audience in Washington had no difficulty in telling just where on the Phyadesphia stage the brasses, tympani, bass viols, and so on were placed. Hum and the other noises are only one three-bundredth of those heard from moving-picture theater sound equipment



HOW YOU CAN PUT

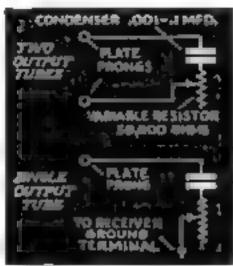
Tone Control

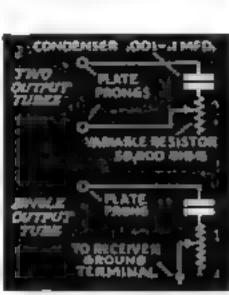
on your RADIO RECEIVER

F YOUR broadcast receiver is not equipped with a tone control, you can provide one for less than a dollar. By foilowing the simple connections indicated, any one can hook up this efficient tone control without altering one connection in the receiver

The auxiliary tone control consists principally of a fixed condenser connected in series with a suitable variable resistor and placed across the output of the receiver. If the receiver has two output tubes in push-pull arrangement, the series-connected condenser and resutor can be connected across the plate prongs of the output tubes. If the receiver circuit terminates in a single pulput tube, one end of the auxiliary circuit is connected to the plate prong of the angle tube and the other end is connected to the ground binging post of the receiver-

Connections to the plate of an output tube can be made by removing the tube from its socket, locating the plate proon by its position (P.S.M., Apr. 33, p. 62) and looping the bared end of a piece of insulated wire around the prong close to the base. In replacing the tube be sure that it is pressed tightly into place and





Comple connections to sees was output tubes make it easy to add a tone control to your radio say of it is not already equipped with one. Left, diagram of wiring necessary

bring the insulated wire out from between the tube and socket by the shortest route. If desired, special wafer adapters can be obtained from any large radio dealer for making these connections.

In the diagram, the variable resistor is valued at \$0,000 ohms and the capacity of the condenser from .001 to .1 mid Since the best value for the condenser will depend on the types of tubes used in the receiver, a range of values has been given. First try the smaller, then the

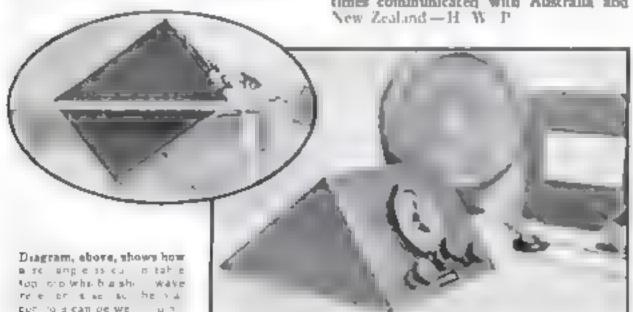
langer, and finally a few intermediate values. Retain the one that gives the best results over the full range of the resistor.

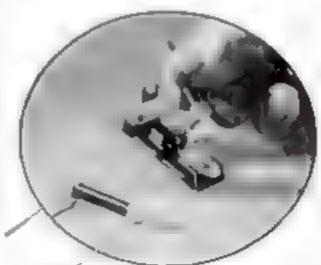
When all the resistance is placed in the circuit the tone control will have virtually no effect on reception. As the resistance is reduced, however more and more of the high frequencies will be sent through the condenser instead of the laudspeaker

Depending on the room available, the variable resistor can be maunted separately or on the receiver panel.

Receiver Sunk in Table Top

AMATEUR radio operators who spend long hours on the air can obtain better tuning and greater comfort by counterainking their short-wave receivers below the surface of the table. As shown in the Blustrations below, a rectangular hole is cut in the table top and the receiver cabinet is set in so the front panel rests at an angle. Wooden braces or leather straps are screwed to the underaide of the table top to form a cradle for the receiver. The rectangle should be as long as the cabinet and slightly narrower than the diagonal of the cabinet end Besides giving greater freedom in dial ing, this angular position of the controls allows better illumination of the dial faces. This system of mounting shortwave apparatus is used by a group of St. Louis, Mo., amateurs who have many times communicated with Australia and





Two of the new passauce lightning accenters

Tiny Lightning Arrester

A NEW type of lightning arrester is now available to the set builder and radio fan It is no larger than an ordinary grid leak and can be attached by means of its pigtails directly to the ground and antenna terminals at the rear of the receiver or mounted in a spring clip as shown above It is also suited for use as a protection on the antenna impedance matching transformer in shielded transmission line antenna systems. One end connects where the transformer attaches to antenna wire, the other to grounded shielding.

reacted, as sight wind gibt

Using the New Tubes



Using a simple adenter, the sidestyle '80 rectifier to being replaced above with the new full wave, mercury vapor tube type '82. Many other substitutions of this nature are made possible by new, economics' adapture

By GEORGE H. WALTZ, Jr.

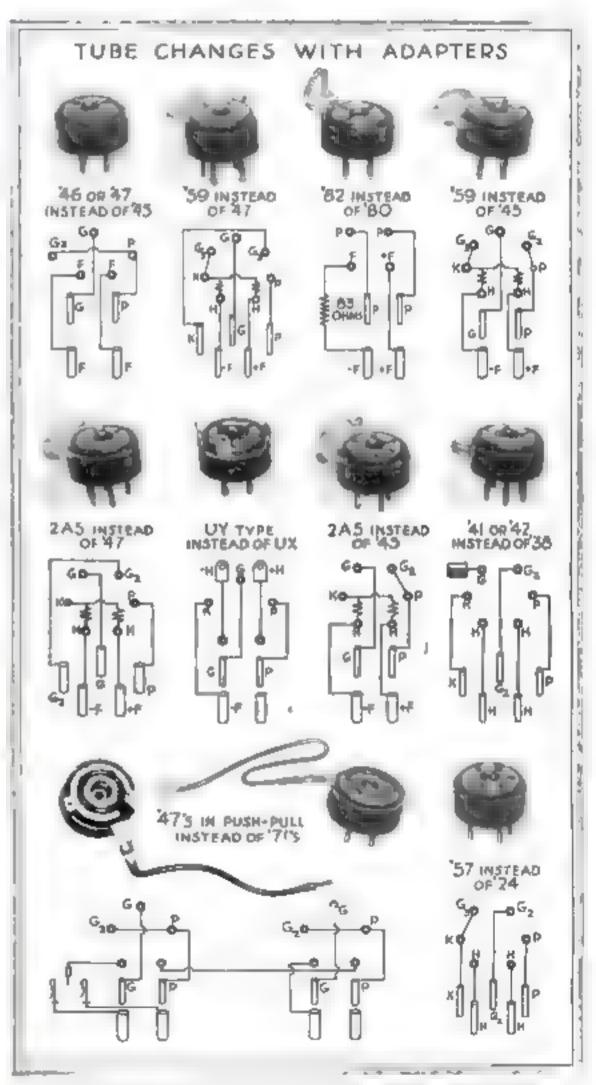
SPECIAL adapters now make it possible to use the new tubes in old radio receivers. Without changing a socket or touching a connection, you can modernize your set by instailing tubes of the latest design.

Hitherto, with each new tube development, set owners have been discouraged by the fact that the improved types could not be used to replace their old tubes. Physical differences in the construction of the tube base and in the general design made direct substitution of the new for the old impossible.

By using the adapters shown on this page direct substitution is now practicable. In fact all sorts of tube replacements are made feasible For instance, small-based UX tubes can be fitted into old bayonet type, WD-11, or UV-109 sockets. Heater tubes of the '56 or '27 type can be used in sockets designed for filament tubes of the 'O1A and '26 variety. Five-prong tubes can be inserted in four-prong sockets and tubes requiring a 2½-volt filament supply can be plagged into sockets wired for 5 volts. Thus o J. style receivers can now be inodernised with new tubes at little cost.

Of greatest interest are the simple adapters that make possible the use of the newer type output tubes in sets designed for the older '71A and '45 tubes. For example, one adapter having a five-prong socket and a four-prong base makes the proper internal connections so a type '47 tube can be placed in a '45 socket to obtain greater volume. The '47 is inserted in the adapter and the adapter in turn is placed in the original '45 socket. No other changes are necessary The adapter connects the '47 into the circuit as a high-mu triode, resulting in increased amplification. This same adapter can be used to substitute a type '46 for a '45 or a type '33 in a '30 or '31 socket.

Using a slightly different adapter, the brandnew 2A5 power amplifier can be substituted for the '45. The adapter, consisting of a six-prong socket and a four-prong base, has a special Adapters Make It Possible to Modernize
Old Receivers Without Changing Sockets



With these adapters, old sets can now be modernized. The drawings under each photo show the connections automatically made by the adapters to allow newer-type tubes to be used in the old receivers



in Your Old Set

built-in, center-tapped filament resistor to eliminate hum. If your present receiver terminates with a '47, you can substitute the new 2A5 tube for it by using an adapter having a sax-proof socket and a five-prong base.

Other anapters make at possible to obtain greater volume with decreased hum by substituting a seven-prong '59 pentode for either a four-prong '45 or a five-prong '47. Both adapters contain stitemal,

center-tapped filament resistors.

buts using two '71's in push-pull arrangement tan be improved by making use of a special dual adapter that allows the use of the newer type 47. pentodes in '71 sockets, No change, other than the insertion of the adapters, is necessary. The two pentodes automatically are wired in series so that no series resistor is required. One adjustment, however, is necessary. Since many sets, using '71's, have the figment circuit crossed, one of the adapters is equipped with a phone-tipped lead and two spring-clip terminals. The lead must be inserted in the terminal that lights up the tubes when they are placed in the circuit. How this set of adapters is wired is shown in the diagrams

In many receivers, a type '24 tube, having a five-prong base, is used as a biased detector. In

these sets the newer 5" can be used as the detector provided the proper adapter is insighed. This same anapter also can be used to replace the type '35 with a '58

About a year ago, a new type of rectifier tube was developed. The '82 rectifier was designed to meet conditions present in new sets and although it looks like its predecessor, the type '80, in shape and internal construction, it has a 21/2-volt filament instead of the 5-volt variety used in the '80. However, by means of an adapter, the '82 can be used in place of the '80. An external, built-in plament resistor cuts the 5-voit filament supply down to the required value, By using an '52 rectifeer in place of the '80, increased filter voltage is

obtained

Adapters also have been developed that make possible tube substitutions in automobile receivers, The newer type '41 output tube, having a sixprong base, can be used in place of the fiveprong '38. A change of this type, of course, makes a grid-clip connection necessary. However, a studis provided on the side of the adapter to accommodate the grid chp aken from he replaced 38 and, as shown in the drawings on the opposite page, connects it internally to the grid of the '41

Building a Crystal Set for the Children



By universing the roil and condenser from a discarned broadcast receiver you can maka an inospensive crystal desector act

LTHOUGH considered obsolete, the crystal receiver still has many uses. This is particularly true in sections close to large broadcasting stations

Hy har ling a crystal set you can provide the children of the family with a theap satisfactory receiver of their own Regardless of what programs the grown-ups want, the children can get the thrill of tuning in their favorate station on their own private radio set. Asa matter of fact a child can build a cristal set houself it he is heiped over the rough spots

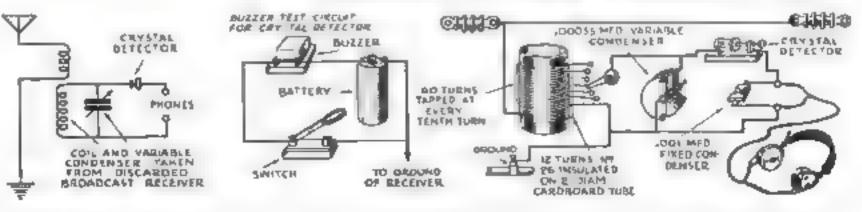
It you have an old broadcast receiver the construction of a crystal set is ereatly simplified. Merely remove the broadcast coils and condenser from the chassis and connect them together with a crystal detector and a fixed condenser according to the diagram below Crystal detectors and eurphones can be obtained from any dealer in radio parts

If you have a pound of No 26 insulated wire, you can wind a receiver coll on a 2-in, diameter cardboard tube. The upper partium of the call should be

tapped at every trath turn and connected to swit h points on the panel A movable switch arm then allows the cifective length of the co-to be changed. The coil, seventy-two turns long is all, should be continuous

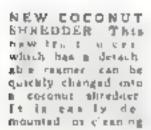
If a crystal receiver is to work, the catwhisker as the small were contact on the detector is called, must rest on a sensitive spot on the crystal. To find a sensitive spot, connect in the buzzer-test circuit as indicated. With the huzzer on, move the catwhisker around until the buzzer is brard in the earph-nes. Since the catwhoker then tests on a sense we spit the businer can be shut off and he receiver a ready for use. Then tev ca h of the six con taps in turn and tune the set with the variable condenser

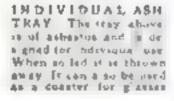
Within twenty-five miles of any large broadcasting station, a crystal receiver of this type should bring in fairly loud signals on the earphones. Of course, it will be necessary to use an antenna separate from the one serving the large electric receiver. For best results the auteuna should be 100 feet long



New Devices

FOR THE BUSY
HOMEMAKER





REST FOR PLATIRON I Instrated in circuit to a new the tanker that a strached to from any board so then a literature in the process y fur aftern I. One advantage claimed in that I caved the board clear for work



SITE I VES IN THE DOOR More old compartments are just the in this of go after a nee whelves are bust him the door in which business and armit can be kept

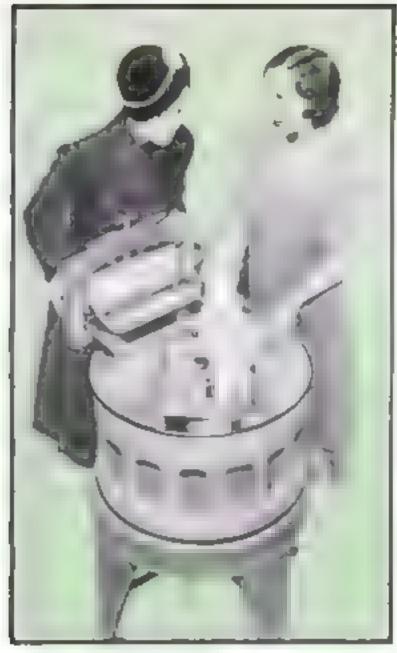


KILLS THE MOTHS. Above and at right, are two views of a gorment container thatis designed to protect clothing from moths. A liquid chemical, put inside it, releases a hilling vapor



XEYHOLE LIGHT
The event plan for
a unionaling the keyhole in a door in to
have a bus (a light
to located that its
rays fall on the hole
A beston turns at on



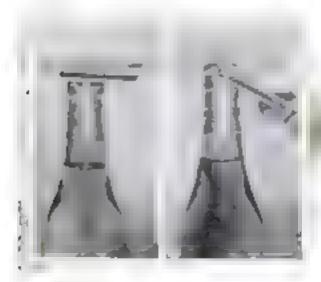


TWO WARHERS IN ONE, This wanter has two comparaments, either of which can be used independently. The amoder, for fragile garments, in sice a dry caracer.



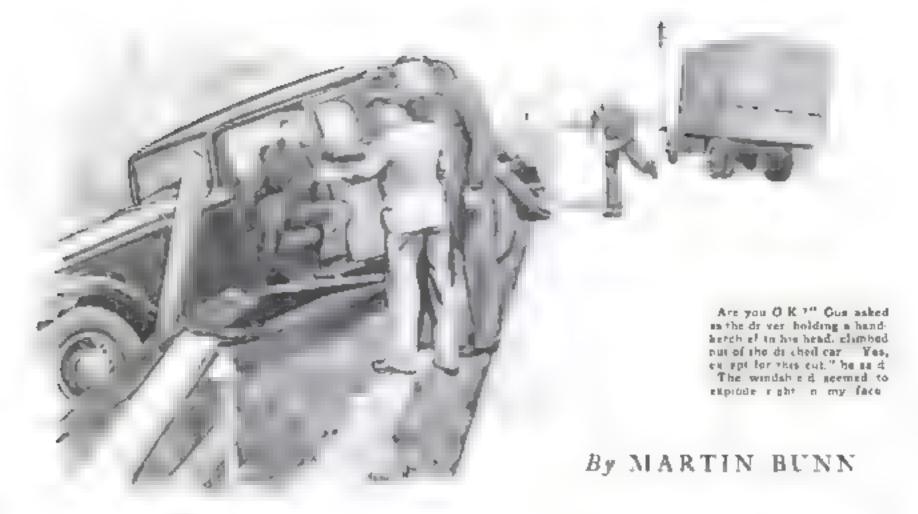
BLICER RAS MANY USES. Cheese is a their sinced or cut late squares with this of cer. It also can be used to since applies for pies of sauce, or new pointoes for frying

OPENER ALEG SEALS BOTTLE. Caps are removed from bottles with the opener below, which also seals them air tight



SAVES THE MEAT JUICE. There is no chance for meat juice to escape from this self-beating greenists cooker. It revolves while in one and the juice is dropped over the meat

OPENER FOR JELLY GLASSES. Tops are quickly removed from joily glasses with the opener shown here. The center grop is for one in removing tops from cateup bottles.



Auto Glass that's Crash-Proof

BRAKES screeched and horns sounded as a hise secan whitzed pas the Model Gazage towicar, cut in sharply to avoid a track, and crashed through the white fence bordering the well-paved highway.

For a moment, Gus Wilson and his partner, Joe Clark, were speechless. Then Gus slid the garage car to a stop and both men hurried back to the wreak. The driver of the truck trotted toward them from the opposite direction.

"Are you O. K?" Gus asked as a small

"Are you O. K?" Gus asked as a small man, holding a red-stained handkerchief to his face climbed but of the ditched car and stood graming sheepishly

Except for this cut, said the man, uncovering a gash over one eve. The hamed winashield seemed to explode right in my face when I hat that fence, Guess I lost control. I didn't see that truck when I started to pass you."

"We'd better get you to a ductor," the truck driver put in. "Cuts like that are nothing to fool with."

"Aw, the cus all right. How about the car" he asked as he surveyed the wrecked machine in the ditch.

Ande from a shattered windshield and a badly crumpled fender and headlight, nothing vital appeared to be damaged. Gus Wilson bent the mangled mudguard clear of the wheel and climbed into the driver's seat

"A busted windshield sure contains a heap of glass," remarked Gus as he carefully brushed the glass spiinters from the seat. "The whole car's sprayed with it." "You're telling me?" said the injured

"You're telling the?" said the injured driver. "When I hat, that windshield just disintegrated. I'll be packing it out of my bair for months."

Gus carefully backed the car onto the road. "Joe," he said, "suppose you drive Mr —er—"

"Kennedy," supplied the man. Live just a few blocks from your garage."

"Suppose you drive Mr Kennedy home in his car and I'll follow in the wrecker?" continued Gus. "And if I were you, Mr kennedy, I'd see a doctor first thing. The car can wait. Bring it around to-morrow and I'll look it over Probably all its needs is a new windshield and a little ironing out on that fender."

GLS was standing in the garage office doorway the next morning when Kennedy, patched and bandaged, arrived.

'West, here I am," he called in answer to Gus's greeting. "Now that I'm al, mended, I guess I'll treat the car to a few repairs."

"How's the cut?" Gus asked, indicating the bandage over Kennedy's eye.

"Fine. Doc says I'll have a scar, though Had to take four statches to close it up." Gus drove the car into the repair shop

and started a systematic inspection of the wheels, brakes, and steering gear.

GUS says:

You owe it to yourself, your family, and the other drivers on the roads to see that your car is as safe as you can make it. Steering gear failures, tire blow-outs, and poor brakes cause as many bad accidents as reckless driving. If you call yourself a safe driver, be sure your car's controls respond quickly. A fraction of a second's delay may mean a bad grash instead of a harmless scrape.

"Looks like your car got off easier than you did." be said as he tested the wheel bear age "Outside of that busted windshield and folded fender, she's O. K. If that windshield had been as up-to-date as the rest of the car, you'd have escaped without a scratch."

"How come?" Kennedy asked

Gus said nothing as he ambled across the repair shop and disappeared through the storetoom door. When he trappeared, he was holding two squares of glass.

See any difference between these?" he asked holding out the two glass sheets.

Kennedy held the two samples to the light, looking first through one and then the other. "They look alike to me," he said, "excepting for the black strip along the edge of this one."

Gus propped the two sections of glass on the repair beach, picked up a heavy wrench and stepped back about four paces. "Now watch, be said,

Swinging his arm in a wide arc, he fung the heavy wrench at one of the glass squares. Kennedy ducked as glass showered down on the repair bench.

"What did you expect it to do, bounce?" Kennedy said, obviously puzzled by the strange performance.

Without answering, the gray haired mechanic tossed the wrench at the second square of glass. Cracks darted from the point where the tool hit, but the glass did not shatter Instead, it held its shape as the wrench rebounded

"Say1" exclaimed Kennedy, "I've seen shatter-proof glass before! but it was always brown and cloudy-looking. I thought those two pieces of glass were cut from the same sheet

"If you d had a windshield made of that stuh said Gus, "you'd have saved a doctor's bil and a mean gash over your eye to boot." (Continued on page 92)

BETTER SHOP METHODS : IDEAS FOR THE HANDY MAN : BLUEPRINTS



MODEL MAKING : HOME WORKSHOP CHEMISTRY: THE SHIPSHAPE HOME

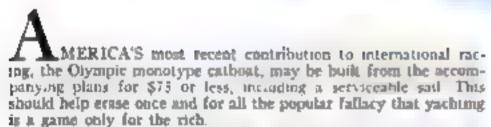
HERE IS THE LAST WORD IN

Racing Cathoats

An authoritative article by the designer of the best one-man yacht yet developed

E. B. Schock

Natural Architect



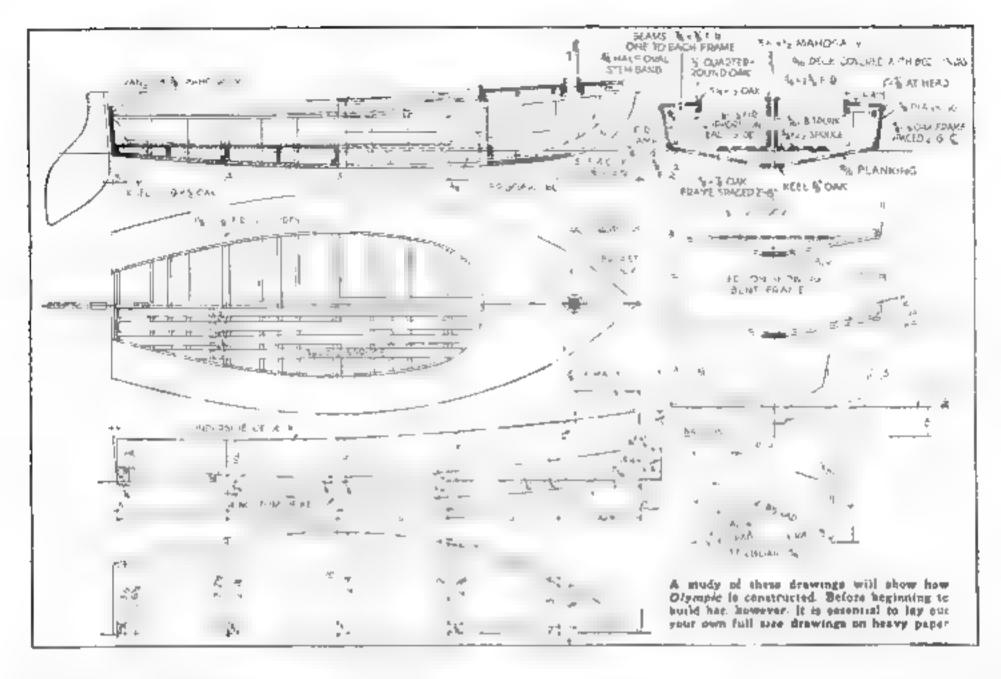
Redesigned from the Snow Bird class, so popular in California waters, for the American Olympic Committee and raced in the Olympic games at Los Angeles, Calif Olympic represents combined efforts to produce a craft easily handled, of sturdy construction, and inexpensive, Her length is 11 ft. 11% in., and the extreme beam is 4 ft. 11 in. She is fast under sail, quick in response to the tiller, and can be used with an outboard motor,

You may suit yourself as to whether you build the framework right side up or upside down. Olympic may be constructed either way, though the plans can be followed more easily with the keel down.

At the outset you should lay her down full size on paper, preferably spread out on the floor of your shop or workroom. It will not be necessary, however, to make full size paper patterns, although you will find it valuable to outline the boat in every respect



So quickly has this monotype cathout become famous that she is frequently seen a the movies and much has been published about her, but this is the first and only article to appear by the noted naval architect who developed the original plans.



From the outline you will have a complete picture of the craft, enabling you to see wherein she differs from any other small boots you may have built.

Athough anyone familiar with tools will be able to turn out a finished boat, careful study of the plana will enable you to build a craft that not only will have a more professional appearance, but will perform better in the water.

First make the form on which to set up the boat, Second, lay the keel on the form and put in the centerboard trunk. The finished keel, measuring 36 by 6 in. by 11 ft. 11½ in., may be cut from a single oak piece 12 ft, long, while the trunk pieces, of course, should be nailed together. The slot for the centerboard should be cut in the keel before the keel is set up

After the keel has been installed, the headpieces of the centerboard trunk may be fitted by forcing two blunt 1/4-m. bolts, 6 in long, or galvanized wire nails of the same length, through the keel and head-

The bed pieces of the centerboard trunk go in next. Of the two usual methods of construction, you will find it easier to drive in 1/4-in, bults 7 in, long from the bottom, but these must be countersunk at the top in order that the next section of the trunk may fit flush

Three bolts or galvanized units should be driven into each end of the headpiece to bold it fast. The other sidepieces of the centerboard trunk must be fastened right through with drift bolts long enough to enter at least 3 m. into the side next heneath. Bolts 7 by ½ in. will serve suitably, although wire nails can be made to do. These should be spaced 8 in. apart—a spacing suitable for calking. Since all

scams, even the bottom one, are above the water bine, not much water can come in through the trunk even though it be puorly calked.

Next, you should get out the stem. You can install the stem either before or after

setting up the keel, though the latter probably will prove more sample. The same is true of the transom

Fasten the stem to the keel with three 4 by 54 in bolts, and secure the transom to the knee with three 34-in, bolts of

MATERIALS REQUIRED FOR BUILDING OLYMPIC

Centerboard 2 pc 34 by 12 in by 3 ft for Univerliand trant. The 13 16 by 6 in by 3 h, 6 in, and 6 pc 13 16 by 4 in, by 3 ft 5 in, all fir or redwood.

Frames 4 ac 3a by 1 a m by 5 ft, or 8 pc m by 12a n, by 2 n o m, and 8 pc 36 by 1 a by 12 n oak

Frames | brost | 1 pc | 15 | 16 by 4 ln, by 3 ft | 6 in., oak

Transom, 36 by 15 in by 3 ft 6 in, mahogany. Planking (bottom), 12 pc 9/16 by 6 in, by 13 it., cedar or cypress.

Planking (aides). 4 pc. 3s by 6 fs. by 13 ft., cedar or cypress. Deck, 6 pc. 9/16 by 4 fs. by 10 ft., spruce.

Prek beams 'ps | x v s' n by 4 ft for Coaming 3 ps 's by 3 s in by 6 ft 3 in oak.

Lance by a by 5 in by 13 ft not kee 1 pr a by 5 in by 13 ft nak. Claring 2 pe a by 1 in by 3 ft for factoring pe 2 by a cm, by 10 ft fit. Hence 4 pr 2a by 4 m, by 4 ft for hines boards. Sipe 3a by 2 ft in by 10 ft., sorting

Stem 1 pc by 10 h by 3 ft oak temericand can 1 pc by 3 g in by 3 ft. 5 in malogany

Rub strake, 2 pc 42 by 132 io, by 13 ft for Rudert I pc I a b, 16 in by 3 ft 6 so., nabor ny

Mart (solid) I be 3's by 33, in. by 11 ft, sorner or (hollow) 1 pc 1 a by 3's in. by 1 th, sprace

ASTENINGS # proces 136-on. No. B.F. H. (flathead) brane screws.

1/2 gross 1/2 fm. No. 3 F H. brain acrews. 1 dos. 3/4 m. No. 10 F H brass acrews. 3 dos. 1 ps. No. 8 F H brass acrews.

2 dos 1 % 40. No. 10 F H brain screws 4 dna 4 in. ova -head brass sevens. 3 doz 191 n. No. 12 gabromzed serens. 2 doz. 15, an. No. 12 pal, acrews, or 1 doz. Acteurs, there I by M in carriage bolts. I doe if in No A gal screek 4 lb tourpens, contrade gar have, 3.16 herepenny copper is remainthe Langal brade I lb. sexpeory common gal halfs 7 % teachering copper is so not 3. 1 314 can F. H. enginee factors by an eyebolis. I S or hard a newton matrix. 6-7 by 14 in bolts (Note: All galvanized screws should be countersunk brans screws may be set flush.

HARDWARE AND FITTINGS 1-6 by 5/16 in turnbuckle. I No. 1114 screw eye 2. Jan. gal blocks (pulleys), last eye t-\$p-in. gal, deck block 2-No. 2 gal, milder braces or hangers 1 4 by ** in gal. eyebolt 1 5% by 4% in screw ringbolt, and 2. 6 m. gal. cleats. 12-4-in, gal, (con most ring). 35 pross brass grommets. 21 St. 34-fa. brouge much cord of rigging cable. 100 ft. 34-in. manila cope. 1 % gt. marine glue. 97 sq. ft. 6-ox. cotton sail twill, and enough Find canvas to cover the deck 2 2b. party and 2 lb. white lead, mixed equally and 1/2 lb. cotton culking.

pc. 4 it by 34 on bait-oval gal, iron.

3 by 1 in brass centerhoard pin.

Paint varaush and sheliac

suitable lengths. These should be forced through both the knee and the keel.

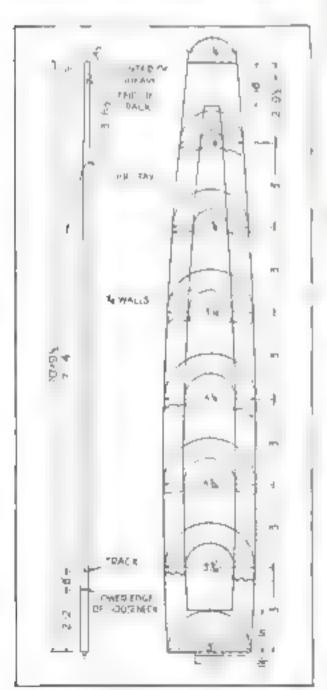
You now are ready to get out the four frames A though, of course they should be cut to shape in autonice, you must take the pieces forming each frame lay them down on the full size paper drawing, and clamp them tightly together at the chine With the clamp in place bore and bolt the pieces together with two 2 by 14 in carriage bolts. The bevel required can be determined from the full size drawing before you install the frames in the boat.

Meant me the limber holes for the chine log may be cu. This may be done eas ly by sawing down ', in, and cutting out the Lin long segments

with a chisel

As the next step, you should fasten the floors to the frame using four 2 by of an earnage bolts in each end after having our ambers through the frame. Now not before is he time to put in the frames, a simile but important step in boat building bear aches made from light, scrap butterial should be not led across their tops to keep them from on lapsing.

When the frame is in the boat put in the clamp and chine log. The clamp should be fascened by a 2 by in, boit through the frame, one bol, to each frame. A, he same time



The meet may be made solid on an abown to the detail drawing from two pieces boliowed out in the center and glued securely together



put in the chine log, securing it with galvanized wire nails one to each frame

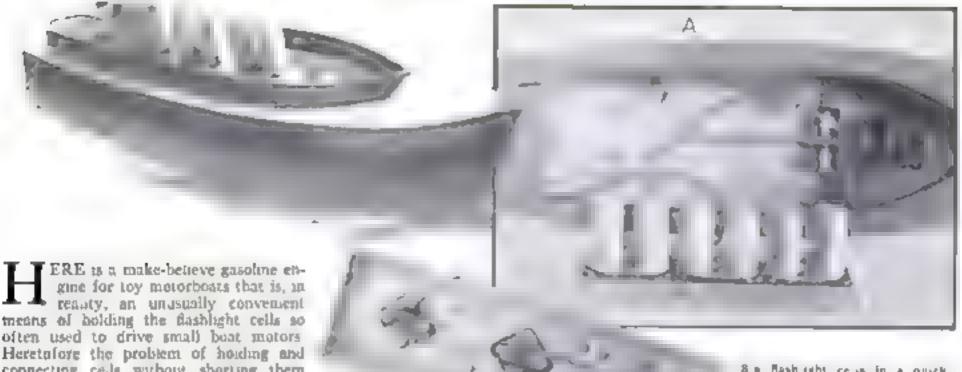
Start your planking using fit or cedar-By obtaining the size specified in the bill of materials, you will find the lumber comes about the right length You should begin with the strake adjoining the keel, clamping it tightly in place to make a neat fit with the calking edge. Then fasten the strake to the frames, using two 1 4in. No 8 brass screws to each frame. Duplicate this procedure with each board on out to the chine.

You will have less trouble getting a proper bevel at the chine if the bottom planks are put on first. The only method of obtaining a good bevel is to fit it several times, looking at it from both the inside and outside at each of the fittings.

The same material used in the bottom should go an o the sides. Before putting on the side planks install the deck beams. At the same time fasten the four fir supports, followed by the carling. Use four-penny galvanised nails, one in each beam. The deck beams should be fastened to the fir clamp by galvanized wire nails, their size and length to be determined by your own judgment. Secure the side planks in the same way you put on the bottom planks.

In installing the bent frames which for combined lightness and a rength should be cut 7 16 by 15 16 in from oak stop 14 in short of the center line of the keel to form a limber (1 intinged on page 93)

Flashlight Cells in Motorboat Model Look Like Racing Engine



reacty, an unusually convenent means of holding the flashlight cells so often used to drive small boat motors. Heretofore the problem of holding and connecting cells without shorting them has been a difficult one. The quick-change feature allows cells to be changed without making a trip back to the shop, as would be necessary if the cells were soldered and taped together.

The sheet metal base resembles the tro-

The sheet metal base resembles the upper part of the crankcase of a gasoline engine, and the cells suggest the cylinders. The cells are connected in senes-multiple two cells in multiple and three pairs in series. This gives 4½ volts at twice the capacity of a single cell.

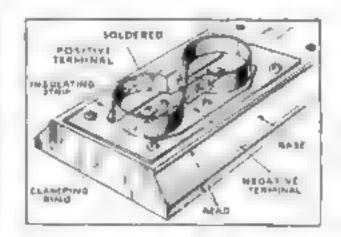
The base is supported by two uprights, marked A in one of the photographs, that fit just inside the base at each end. The length of these supports, shape of lower ends and method of attaching to the hull will depend on the kind and shape of the hull.

Details of the parts are given in the drawings. The base and clamping rings may be of tin plate. The insulating strips may be 1/16-in, bakelite, fiber, or celluloid. The negative terminals may be 18-gage galvanized steel or 1/16-in, brass. The positive terminal may be of spring bronze, cut from weather strip. The clamping rings should be bent into shape around the bottom ends of two cells, and the clamping screw put in place. The negative terminals should then be screwed down, the rings being held in place on them

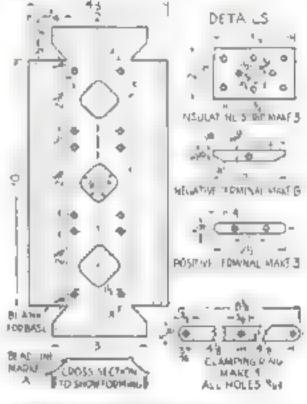
while the soldering is done. The cells are then taken out and the posi-

tive terminal screwed in place. The ends of the latter should be bent up as shown in the assembly drawing.

When the top ends of two cells are pushed down into the rings, the center terminals make contact with the positive terminal, and the zinc cases are in contact with the negative terminal. The clamping is accomplished by tightening a machiniscrew, which posses through the holes in the clamping rings. All machine screws are No. 6/32.—R, W, Wagner.

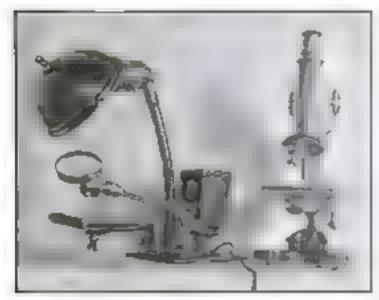


So hashight ce is in a quick hange he der des gred for boa models and at all a horsom view showing with connect in This hail is of one at any 27 one but the me It is can be used in almost any versely of mode.



Details of the base and other parts and, at less a drawing abowing an assembled unit

Inexpensive Four-in-One Unit Helps Beginners Do Better Microscope Work

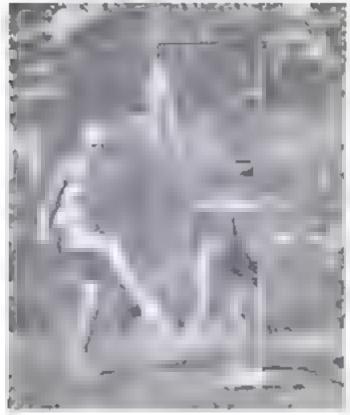


A meful microscope accessory made mainly from odds and ends. It includes understage and overstage lamps, a turntable, and an adjustable glass



Now that the nucroscope has become so popular, some readers may wish to construct this compact combination outfit consisting of (1) an adjustable understage light, (2) an adjustable reading glass, (3) an adjustable dissecting turntable, and (4) an adjustable above stage light. The understage light is of a well-known standard make, mounted on a rear-view automobile mirror. The flexible lamp standard and socket are from an old desk lam, The reading glass support is made from electrical fittings purchased in the "five and ten," The turotable dissecting platform is an old tin frame with a glass top and green felt underneath. The felt is glaced to a brock of wood which is draked and fastened to the pivot screw going through the end of the arm that supports the turntable.—OSCAR FREEMAN

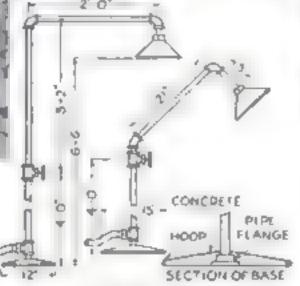
LAWN SHOWER KEEPS CHILDREN COOL



A LAWN shower bath for chadren can be made at small expense as shown in the accompanying illustrations. This fixture may also be placed beside an ordinary bathtub and connected to the mixing faucet by a short bose, or it can even be used near a floor drain in the basement by connecting it to the hot and cold lines

through a Y and a hose connection.

The base is a pipe flange cast in a circular concrete block or fastened to a flat board or an aron casting. The standard is made of 52-in. galvanued pipe and standard galvanized fittings, A regular shower head can be used or a cheap one purchased at the ten-cent store, or a bose sprinkler head will do very well for an outdoor shower. The cost of materials to make the one illustrated was \$1.94 -Euri, D. Hay



Suggestions for homemade abower fixtures. and a photograph of one that cost only \$1.94

CAMP WASHTUB MADE FROM CRACKER BOX

CLEANLINESS in camp is made easy with this combination washboard and tub. which also serves as a compartment to carry canned goods, cooking prensia or other equipment while traveling

Obtain a large tin cracker box from your proces and have a tinsmith make a corruga or zinc washboard with a metal edging to prevent cuts and tears in the clothing. It should be hinged inside the box lid as shown. It will be seen that the board is hinged in such a way that he water runs back into he box. After esc as a wash no, the box should at

The cost for the box and w shboot! was only \$1.25. It's assembly was com-

room apartments also may find use

LYE ETCHES DESIGNS ON ALUMINUM

You can improve the appearance of aluminum articles by etching decorative designs in the metal with a strong alkali solution. Wherever the fluid touches the metal, it produces a beautiful motte surface that contrasts strikingly with the usual polished finish of alaminum pitchers, syrup dispensers, aquarium frames, and the like.

Coat the area to be decorated with a paraffin film a few thousandthe of an inch thick. This is done by heating the metal sligh ly and then rubbing it with a piece of the wax, Reheating will distrib-

ute the paraffin evenly. Draw the design on a piece of paper and outline it with pinholes spaced fairly close together. Lay the paper over the waxed surface of the aluminum and go over the design with a piece of cloth moistened—but not wet—in gasoline or benzine. Let the liquid evaporate and then remove the paper. The design wilbe outlined by a series of tiny dots where the gasoline came in direct contact with the coating. Although not prominent, the dots can be seen plainly enough to be used as a guide in removing all the wax from the areas to be etched

Use a sharp, slender knufe to scrape the wax from the metal. You can make a suitable tool by thrusting a needle eyefirst into a wood handle and then grinning the other end so that a sharp, diagonal edge is produced. Be sure to remove every trace of war from the aluminum wherever you want the alkali to act.

Make the etching solution by adding a teaspoonful of water to an equal quantity



of washing lye, This produces a thick liquid that you must keep from your fingers and clothes. Apply it to the aluminum with a piece of cotton wrapped around a stick, being careful not to touch

parts of the article where no design is desited and which are not protected by wax Exchang will require from 5 to 30 minutes, depending on the depth desired, acrengin of the lye, and other conditions,

Finally, wash the lye off with clean water and remove the protective parafin coating by pouring boiling water over it. No further treatment or finishing is required.-WALTER E. BURTON

Unique BIRD HOUSES

A new and easy way to utilize odds and ends of lumber in making a large variety of strong, graceful nest boxes



serod naw was metery fort as a serod naw was metery fort as a serod house constructed in the serviced loard saw-houser and has method, then it would be wor by of him e However try one of these has your 1 g naw and 1 ll wager the salure is for bird-bouse purposes no gipherhood will take a sump

The inexpensiveness of material the indicity of construction, the heavily of the heavily of the heavily of the parabolic variety of the gas which can be worked out are upone features of this sy-

The first step in making any of the houses shown is to lay out on a piece of caroboard the full-mised front view, using the 2-in, squares as a guide. Cut out the pottern, following the outside line and the line of the nesting cavity

A NEW SERVICE

FULL-SIZE PATTERNS for Three Bird Houses

Do you find it difficult to understand mechanical drawings and to lay out your work securately? Many readers do, and for that reason they are handicapped in taking up craft work, What they need to give them a good start are full-size patterns as easy to follow as the patterns sold for making women's clothes. POPULAR SCIENCE MONTHLY has prepared patterns of this type for three bird houses—the wren house marked G in the group above, the larger house immediately below it, and the still larger woodpecker house on the opposite page. All three will be sent for 25 cents. Use coupon on page 80.

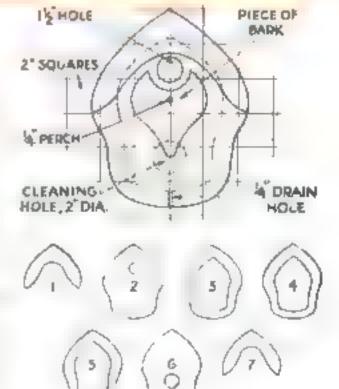


Above Seven with house designs drawn on 2 in squares and a photo of the hist house Right House for bluebaid t impuse thicksdes publish awailow, or downy woodproket

Next, the material should be selected Paying no attention to the kind of wood or its quality, pick out as many pieces as you can find with a thickness of from 1/2 to 21/2 in, on which the pattern will fit If necessary, you can use a board which is twice as long as is required but only balf wide enough by sawing it in two gluing the edges together, and clamping until set. The glue used should be of the absolutely waterproof variety such as a good casein glue

The marking of the sections is now in order. The house shown at the right will be used as an example. This house has a nesting cavity depth of 5 in. To make the required depth, select us many of your thickest pieces as are necessary to give a total thickness of 5 in or a little over in the house shown, three pieces slightly less than 13% in, thick were used. On these sections fasten the pattern down with thumb tacks and mark around both the outside and inside

Select two pieces not over 1 in, thick for the front and back sections. Fasten the pattern in the same manner as before



and mark around the outside only Also mark the entrance hole on the front section and a 2-in. cleaning hole on the back section

The caves should now be marked on smaller pieces of wood. Their upper edges

Jig-Sawed from Scraps



Prize Winners

IN OUR

Novelty Jig-Sawing

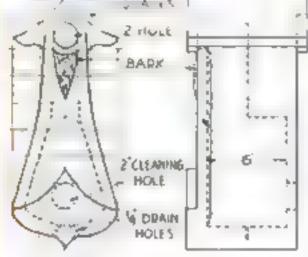
re riviles can be made with a grawly was the question we recently asked our realers in all tricing a grawing cotest. It's M. Mire is p. b. Many exic ent. Buggesti in were to cover. These were raid by the lackes in repairs of 50 plants for very 25 for craft shapes p. 15 for simp. Hy and C for presentation. Pures save been awarde as follows.

F RST PRIZE, \$73 Ernest V Baker, Laborette, Ind SECOND PRIZE, \$15 Bill Chancy, Wahrheld, Mich.

THIRD PRIZE, 85
The may B. Owens, Cleveland, Ohio
1 INF PRIZES \$1 PACH

D. C. Marthall, Manhattan. Rand Hugh Mutabin. Seattle, Wash. Rich eet Putgee Ochhood, Wite, B. J. Creighean. Leavenworth, Kans., Theodore Jeffeles, Nework, Okto.

Don't Annue Cuy, Mr., O Las mann V. Louis Mo., Fire M. Gunday v. ander, Wix Meri Janes, Mason, Jones, W. B. Privall, Indian 1821, Ca., F. L. Renter, W.





THE SECTIONS IN DODER FRONT TO BACK

should be marked with the same pattern as has been used for the main sections but the underside should be marked with another pattern made of paper. There is no need for great accuracy in this case.

With the sections all marked place an "X" on each where it will make no after the surplus is cut away. Small maccurates in the pottern will make no difference if the sections are put together with the "X s" all facing one direction

Now for the cutting Drill a 1/4-m, hole near the line in the waste part of the wood on the sections where an inside cut is necessary, namely, the cavity of the rentral sections and the entrance and cleaning holes. Threading a fairly heavy saw through one of these holes, fasten it in your jug saw and cut out the made portion marked. Having finished all the inside cuts, cut accurately around the outside lines.

If the house requires bark on the inside and outside of the front section, such as the house being described and also the woodpecker house shown above, the inside bark should be put on next. Fasten the bark with casein glue and small brads.

The sections are now ready to be assembled. After making sure that the "X s House for red-headed or guiden-franced woodpeckers and at all the working draw-tage and small diagrams showing the parts

all face in one direction, glue each surface of adjoining sections where they come together. Line up the sections accurately and then clamp the whole assembly.

When the bouse has been taken from the clamps, any irregularities in the surface can be removed with very coarse sandpaper and the edges rounded very slightly. Fill any holes or cracks with a waterproof crack filter

Now hore the drain hole or holes in he buttom. Fasten the bark to the front of the front section, if the plans call for it, and insert the perch.

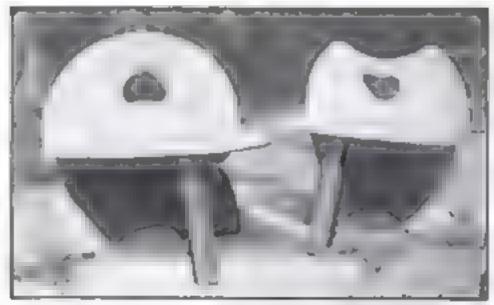
A simple pair of brackets for suspending the bouse can be made from strips of metal. Using a metal cutting blade on your saw, cut out two straps of sheet copper, aluminum, or brass 4 in, long and 1/2 in, wide. Fold there in the middle to form double strips 2 in. long. Bore a small hole 1/4 in from the fooded end for the support his wires or evere's and another an from the opposite end for the 13in, screws which fasten the brackets to the roof of the house. Put the folced end of the strips in a vise up to 1 in from the open end and spread these open ends apart until the angle conforms to the gable of the house. Screw them to the root

The houses shown had one coat of sheliac and two coats of varnish stain. However, every craftsmen has his own ideas on how a bird house should be finished, so this will be left to the individual faste. At the same time that you finish the house, put a similar finish on one side of a metal disk 3 in, in diameter. This disk should have four holes for screws hored 14 in, from the edge and spaced equidistant around the circumference. After the finish has dried, screw the plate over the cleaning hore, using small screws.

Hang the bird house up, preferably faring south or east, and it's ready for the first tenant.

CHILD'S CHAIR NEEDS ONLY THREE PIECES





Reat, usefulness is combined with economy in these ingenious stools. They were designed for children, but from the way in which they are appropriated by grown-ups at every opportunity—well, possession counts nine points in the law!

The materials required are few. For each stool allow one piece 16 in, wide by 17 in, long for the back, and one piece 12 in, wide by 16 in, long for the seat, these should be 1/2 in, thick. Also obtain a 12-in length of wood 2 in square for a leg, and three 2½-in, screws for attaching the seat and back. If wide stock is not avail-

able, put two pieces together with waterproof glue and corrugated fasteners.

The essential tools are a compare saw, an expansion bit or large auger, knife, chisel, wood file, and a light plane. A compass is handy for laying out the work, but a makeshift—even a noil and a piece of string—can be made to answer the purpose

Three different designs for backs are shown, but all have the same quaint, squat proportions. There is nothing in construct-

Working drawings and suggestions for three different backs. The sears are picked up by means of the ornamental kandholes mental kandholes

ing the chairs to tax the ability of even an amateur. Making the legs will probably require the most time. First lay out the octagons at the top and bottom, making allowance for the taper, After the leg has been shaped, cut a round tenon on the upper end, making at fit the 1½-in, hole bored in the seat. With only a knife, a wood file, sandpaper, and patience, this tenou can be shaped to fit almost perfectly. Make this joint tight, but do not force it enough to split the seat. Secure the leg

by driving in a thin wedge as shown in the plan view. To prevent splitting, locate the wedge so that it is across the grain of the seat. Of course, if a lathe is available, turned legs may be substituted for the ones shown.

A groove about 1/2-in, deep is chiseled in the back to take the straight edge of the seat. Shape the groove at the ends to fit the bull-noised edge of the seat neatly. Fasten them together with three 21/2-in, screws. Good glue, of course, helps to make strong joints

Any easily worked wood may be used. The stools shown in the

photograph were made of white pine, and the legs of redwood. As they were intended mainly for outdoor use, they were given two coats of enamel (bright yellow), and the legs were finished in their natural color with two coats of boiled linseed oil. For indoor use, as fireside stools, leave the wood natura), using half on and half turpentine. If you wish, give them an antiqued appearance by rubbing in a touch of burnt umber or other brown pigment here and there.—James Thomas.

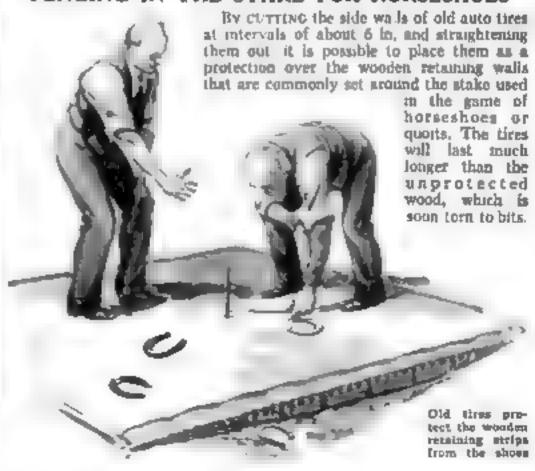
CHEAP AGITATOR FOR CHEMISTS

IN CHEMICAL WORK IT IS often necessary to agitate various chemicals. This constant agitation may be required either to bring about a reaction or to insure a perfeetly homogeneous mutture of whatever ingredients are being used. The instruments soid for this purpose, although convenient and well designed, are expensive, and for that reason the writer devised a little machine that employs an old electric bell. This is illustrated at the right. The goog was removed and a sheet metal paddle soldered to the end of the clapper arm. When used with a 6-volt bell-ringing transformer, this little agitator serves its purpose almost as well as commercial apparatus.—B. C.



This agreerer in made by soldering a small metal paddle to the clapper arm of a common electric bell

FENCING IN THE STAKE FOR HORSESHOES



Bath-Robe Cord

KNOTTED IN SPIRAL DESIGN

By Kenneth Murray

The knotting 4 begun at he mildle and a ruler in aid over the co do as shown at the loft to keep hem separated, with the colors a ternal ng. Then a tow of double at a knot in seed pround the hier cord, which runs from left to I glit

THIS new bath-robe cord is knotted in a way different from that commonly used, It is easy to make, yet distinctive and novel in appearance, and it has durabuity beyond all ordinary re-

Stretchone the

completed cord

quirements, bilk value cord
and ordinary slipknots like those
used in making the wampum beli
described in a previous article
, P. S. M., May '33, p. 63) are employed.

The colors used are, of course, optional.

For a cord similar to that illustrated, four 30-ft, lengths of blue and four of light gray are needed, also one 40-ft, length of light gray for a faller cord. Half of each length is tied up in a hank, because the knotting starts at the middle. After making a row of knots over the fisler cord with all eight strands, the ends of the row are brought ogether and the knotting is continued in spiral fashion. The blue and gray cords will automatically become spiral in design, giving a sort of

block 2 by 2's in, and soldered

After 27 in, of the cord have been imotted, the work is reversed and an-

other length of 27 in is made from the middle. Then grasp the cord at

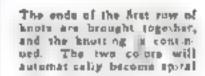
the ends and pull as allustrated above. It should stretch out uniformly and easily to the required length of 6 ft., and thereafter will remain that long

Instead of finishing

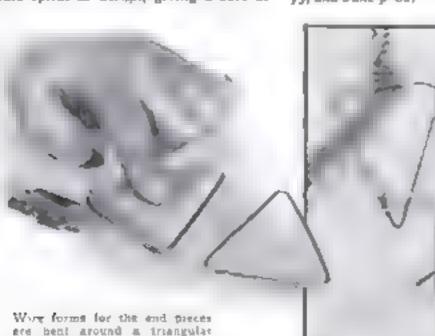
the ends with tassels, pieces are made in the shape of open acrowheads over forms bent from wire. Common bailing wire is suitable. The illustrations show how these wire forms are

covered. The center stop inside each arrowhead is knotted in the same manner as the warmourn belt

For other articles besides that mentioned on the manipum belt see P.S.M., Nov., '32, 9, 77, Mar. '33, 9, 68, Apr. 9, 75, and June 9, 82,



When several technic have been completed, the apizally knotted cord will appear as at the left It will be about to thick as one a sixtle finger





The photos at left and above show how the cords are knowed over the word form, how the form a covered.

and how the fist section is knowed

RIGGING

Our New Galleon Model

By Capt.

E. Armitage

McCann



HOSE ship model builders who are constructing the Eurabethan galleon Revenge and have kept allreast at he work out neg in the three preceding articles (P.S.M., Apr., '33, p. 65, May p. 67, and June p. 66) are now ready to begin

the rigging in earnest.

For the lower rigging, use 1/2-in heart-shaped dead eves and for the topicasi 3 losin, deactives. Round deadeyes in 50th he used but are not strictly correct. These and the nocks are best made from boxwood or other hardwood, but celluloid or other materials may be used. The deadeyes may be black but I made mine brown and used brown languard of size a cord.

The simplest way to make heart-shaped deadeyes is to plane up a long strip of nonspiriting wood such as boxwood, oblong in section, the edges being the thickness of the deadeyes and the width equal to their extreme length, as shown at B in the drawings on page 86. Score that long strip down the center of

both edges to form grooves. Along the flat side mark the shape of the deadeyes, one edge being the base and the other edge the apex, as illustrated. Drill the holes, then cut off the waste piece at one end with a fine saw. Now groove this





The magner and homeventure shrouds and, above the rigging of the fore-lopmant and the topgaliant man

Left Looking down on a mast top Compare this photograph with the drawing of a top given on page 46 slanting end with a file as shown at C and round the corners slightly. Cut off the first deadeye as at D and groove the one temaining edge; then slightly round off the faces and remaining corners as at E. Continue this way, one deadeye at a time

The deadeyes must now be fastened down to the channels. I did this with No. 20 copper wire by taking a turn around the deadeye and twisting it underneath as shown at F, then twisting an eye in the lower end, (Continued on page 85)

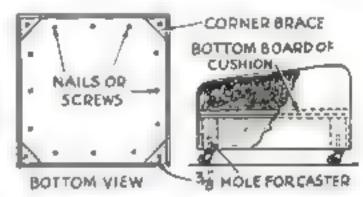


COMFORTABLE SLANT-TOP OTTOMAN MADE FROM OLD AUTO CUSHION

The auto trashers is merely mounted on a box fixed with casters, and the while its covered with an table unbeliatory alloth placed on box and wellian reparately.

The ottoman illustrated was made in about an hour's time from a discarded front-seat cushion from a coach type auto. The stant makes it unusually camfortable

A local grocery supplied a wood box of approximately the dimensions of the bottom of the cushion, and the two were nailed together as shown below with the box set bottom up. A block of wood was nailed into each corner of the box and drilled to take a coster. The tapestry cloth covering was placed on box and cushion mrately. The cushion cover was made large enough to velop the whole and was fastened with thumb tacks the box to facilitate removal for cleaning. If storage nace is desired for magazines, sewing materials or the like the box can be used right side up and the cushion d to it. The cushion and box covers would have carriedly separate in that case.—D. A. Butter.



INCENSE BURNER TURNED FROM WOOD

MADE of hardwood and finished either with point or with stain and variesh this incense hurner is an attractive and easily constructed novely for gift purposes.

Prepare seven wedges according to the

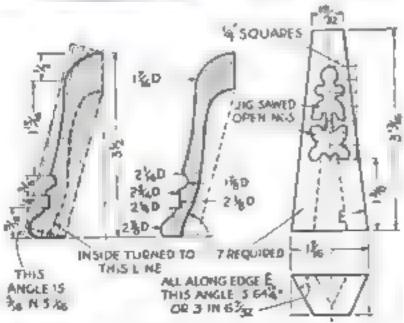
limers one given, trace on each the pierced design. drill, and jig-saw. A blade less than 1/16 in. Wide should be used. With careful sawing, no other smoothing of the holes is needed. To cut the beveled edges, tilt the saw table to 64,4 deg, from the horizontal, or 2554 deg, with the vertical. Verify the setting by cutting a test block and comparing it with a bevel set at an angle of 3 in. in 67 s2 n. Use as wide a plade as possible to insure straight cutting. Straighten the edges with a plane or on a sanding disk,

Casein gase is especially adapted to the gloing of this piece. Coat all mating surfaces and rub the pairs to-gether individually, building up the mass a wedge at a time. When the assembly is complete, wind a few turns of flexible stranded wire around the center and force them downward to clamp be parts. Be sure the latter are in alignment, and glue the base temporarily to a piece of thin plywood.

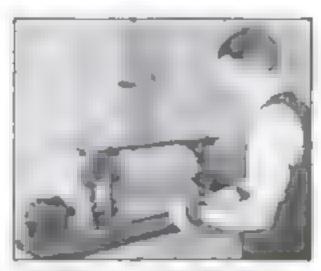
When the glue is dry, trim the base block and mount it on a lathe face-plate Turn at a fairly high rate of speed with ight cuts, and sand thoroughly

Then split away the base block. Put a thick block on the faceplate and bore out a chuck into which the work can be forced for inside turning. A sharp \$4-in. shiel is useful in this operation

Finish the burner as desired. If walnut or maple has been used an attractive antique finish can be obtained by filling with a muxture of floor wax and rottensione, well waped off across the grain and , ked out of the holes. To prevent marring the Enished surfaces on which it may be placed for me, glue a ring of thin felt on the bottom. Use any suitable small receptable to hold the burning incense inside the wood.-E. M L.



The segments are cut out, jig-aswed, then bevelod on the edges and glued together, and the whole is turned to shape



WRINGER CLEANS GLASS

An our laundry wringer can be put to profitable use to clean glass, metal, wood, and other flat materials, as shown in the accompanying photograph. The wringer is mounted solidly on the workbench. Strips of discarded canvas belting are cut up in small disks of uniform size and packed solidly on the two rollers. These serve as an excellent buffing material. A pulley attached to an extension on the top roller receives the power from a small electric motor. This simple device does excellent work.—I K. Novins,

HEATER FOR TEST TUBES



REPLACEMENT units for use in electric heaters of the bowl or reflector type are wound on porcelain tubes and therefore make excellent slow heaters for chemical experiments, Most of them have an inside diameter large enough to take in the smaller test tubes. If enough time is given, a boung temperature will be reached —A. H

Handy Hints for Motorists

Suggestions Valuable to All Car Drivers Are Contributed by Experienced Readers or that a range of right for great which your years who a set offered

LTHOLGH a flashinght as a conventent accessory when making emergency motor repairs or checking the oil at night, it is generally not in the car when most needed. However, the amateur mechanic can provide a convenient motor light by installing an ordinary dashboard lamp fixture on the front surface of the dash or motor compartment cowl. The dashboard fixture should be of the close type having a built-in switch. These can be purchased cheaply from auto parts dealers or can be galvaged from old cars in an autu graveyard. The metal dash or cowl forms the ground and the second wire is connected to the ammeter. By removing the glare shield from the fixture you can fit it with a headaght bulb .- L. VAN T.

Reflects Traffic Light

OVERHEAD traffic lights, cut from view by the top of your car when you head the line at an intersection, can

be made visible by a simple windshield sellector made from a block of wood and a highly pousbed, nickel-plat-ed, steel furniture log glule As shown in the illustration, the glide or caster is driven into the top of a triangular block of wood. To avoid splitting the wood, it is best to drive the glide before cut-

ting the block to shape. Glue the wood block close to the bottom edge of the windshield and in such a position that the dome-shaped surface of the girle is seen easily from the driver's seat. When properly placed, the curved glide will reilect the overhead lights,-- l., C. P.

Speed Governor

PERMANENT harm can be done a new car by draving it at excessive speeds during the first 2,000 miles. A short length of one half meh pipe can be made to serve as a sample speed governor during this period. The fuot knob on the accelerator is first removed, the short pape

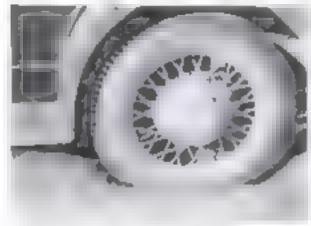
slipped over the rod, and the knob screwed back into place. The іміне от врееле then prevents the accelerator from being pushed down below a certain point according to the

maximum speed recommended. Cut the pape approximately to length and then add thin washers to obtain the final speed adjustment. You can judge the approximate length of the pape by pressing down

the accelerator until the highest speed at which the new car should be draven is obtained. Then note the distance between the underside of the accelerator foot knob and the floor boards and cut the pape to fit. This sample device also would prove of genuine use when the mexperienced person first starts driving as it would prevent sudden jerks.-- F. X. P., Jr.

Wire Netting for Sand

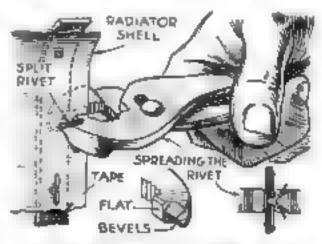
FOR the summer motorist who intends to travel off the paved highways at the seasbore, a four-foot strip of chicken wire netting will prove a useful addition to the tool kit. If the car gets stuck in the sand, it is necessary only to slip the strip of netting under the wheel and apply the power The wheel resting in the sand will climb right out of the hole without the usual ppinning and strain on the drive shaft. The same strip of netting can be carried during the rest of the year for use in case the car gets stuck in the mud. Being flexible, the netting can be rouled into a small bundle and stored under the sea. - K. F.



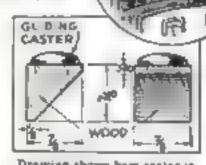
Wire serving carried to tool how is hespful if

Rivet Pliers

WHEN replacing small aght rivets, it is often difficult to fasten them with ordinary tools. This is especially so when it is necessary to renew the rivets that hold the canvas lacing to the radiator shell and cowl of an automobile. By reshaping the tip of an inexpensive pair of slip joint pliers, however, you can make a special aplit rivet tool. On an emery wheel, regrind one jaw to a beveled point for a distance of 1/4 in, back from the ig. Directly behind this angle, also slightly bevel the sharp edges of the flat jaw. The \-shaped tip is used for the splitting operation while the beveled flat portion at the rear serves for squeezing the rivet dat -- W H. A



Drawing of ally joint pliers reshaped for use ss a special aplit rivet tool for emergencies



Drawing thows how easter in set to reflect overbead light



A piece of haif-inch pipe, set beneath the accelerator, keeps car within permitted speed

Small Electric Power Plant

RUN BY OLD AUTO ENGINE By J. L. Bird

This economical electric power plant won fourth price in our recent Auto Engine Cantent

ANY districts in our country are still without electric power facilities. It is quite easy and mexpensive to construct a dependable power plant by using an automobile engine for the motive power

The chassis of a disearded or wrecked car, stripped of all equipment except the engine and radiator serves as the mounting for the generating equipment. The drawing below shows a Ford "A" engine but any other type will serve equally well

Support the car frame on two wooden borses made as shown. To reduce vibration, build in rubber pads constructed of several layers of inner-tube rubber. The rear support should be higher than the front so that the generator shaft will be perfectly level. This will eliminate excessive armature end play

Purchase from a dealer in used electrical equipment a good 5-KW 115 volt

D.-C. compound-wound generator. A shunt machine will also serve, but the compound winding will give better voltage regulation on heavy loads. The cost of such a generator at second-hand value will be approximately \$50.

The builder should also purchase an engine speed governor, such as that used on Fordson tractors, costing about \$14

On the teat of the engine-transmission housing, mount a drive polley at least 10 an, in drameter

Support the generator on hardwood cross members as indicated. It is recommended that the generator be fitted with a flywheel, which will tend to maintain a more artiform generator speed when heavy erec rical toads are suddenly applied or removed. An old automobile flywheel or the type used on cordwood saws will serve admirably for this purpose

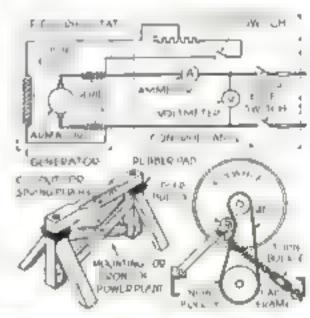
The generator's rated speed will prob-

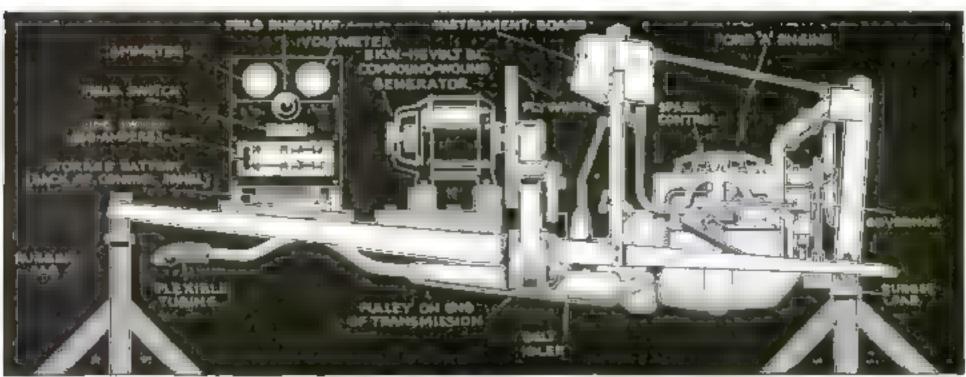
ably be 1,800 a. r. M. The most economscal engine speed is in the neighborhood of from 900 to 1,000 g P M. The generator belt pulley should, therefore, be approximately one half the diameter of the drive pulley. A belt-tightening device to maintain positive belt tension is easily constructed, as shown

The regular car gas tank should be mounted on supports to use gravity feed for the gasoline. The instrument panel may be left intact in its original position

Engine controls may be left nearly unchanged. The gear shift lever should be bent forward to clear the generator Spack control may be had by mounting a small lever on the engine head. The governor will operate the throutle, Electric starting may still be used and may even be arranged for remote control

A control panel containing an ammericaa voltmeter, field rheostat, field switch and me switch is shown on the ske . h. The meters are not absolutely essential, but serve to check output and voltage





The general errangement of engine, generator and switchboard, and (above) the wiring diagram, believightening device, and one of the horses



CALIBRATING A JOINTER

WHEN chamfering cutting rabbets, or planing the edge of a piece of wood for part of the length, it is a great advantage to have some way of setting the knives of a small jointer to cut a shaving of definite thickness

bet the table at zero by laying a block of wood over the knives and lowering it until the cutting edges, when turned by hand, just graze the wood. On both the stationary and the movable enember of the base, make a pen mark across the inclined slide. Then lower the table until the knives cut 1/4 in deep, and on the table costing make a mack extending from the zero mark on the base. Divide this length in the middle haive the resulting spaces, and halve them in turn. The short divisions represent cuts of 1,37 in; and it is easy to estimate by eye the 1/64-in positions between. When the knives are reground, relocate the zero mark.-E. L.

QUICKLY CONSTRUCTED BOAT TRAILER

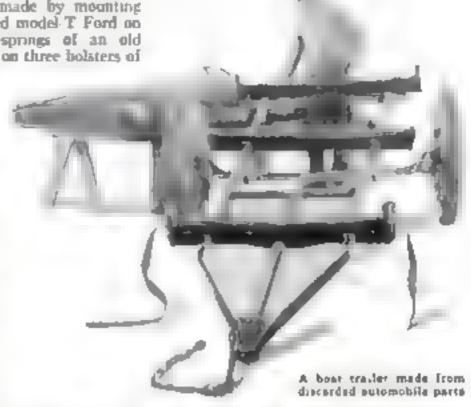
A NEAT, serviceable, and inexpensive boat trailer may be made by mounting the chassis of a junked model T Ford on the front axle and springs of an old Chevrolet and bolting on three boltters of

2 by 6 m, wood. A T-shaped drawhar of 3-us, pape is welded into the front and braced with two sections of 2 by 1/2 in, bar stock, as shown.

A section of garden hose is applied to the top of each bolster with nails The beads of the nails are driven through the top layer of rubber and tightened against the anner surface of the bose. The 6-in standards at the ends of the front

and rear bolsters are wrapped with rubber, which is tacked on the outer side Web straps are applied to the ends of the bolstern, to be buckled over the boat The firest finish is not marred in transporting a boot with this trailer, which may be used for either speedsters or utility

boats,-Joseph C. Covill.



LINOLEUM CUT WITH SAW

APTER blistering my bands and making a botchy job of cutting lineleum with a knife to fit in recesses of the kitchen and around the gas and water papes, I discovered that a small hand-type scroll saw is ideal for this purpose.—R. W. McP.

Compact Breakfast Nook Folds into Cupboard under Window

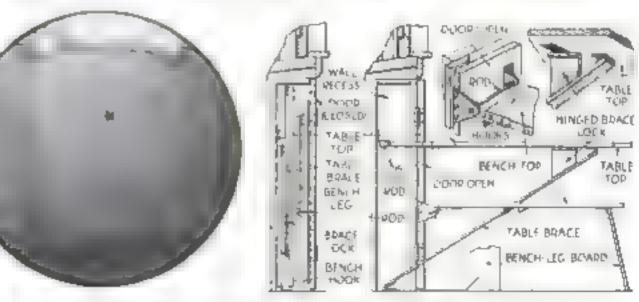
Almost like magic this entire dining alcove outfit, which includes a table and benches for five persons, can be unfokled out of the wall from a small cupboard under the window. The table, 27 in, wide and 50 in. long, is in two parts, supported by a brace. The brace is also in two parts, so arranged that the table can be folded or unfolded by a child.

When the table is extended, the supporting brace automatically locks so that it cannot collapse until released by band The lock is a triangular piece of heavy brass lunged under the table. It falls by gravity as the lower supporting brace comes out straight and prevents the brace from going back by accident. In folding the table this triangular piece is pushed to one side while mising up the brace The result of the table then drops parily the supporting brace strikes he table farther back, and the table then rides and makes the second fold autoreacted by on the brace as it moves back into the wall. It happens to be so balanced that no real force is required to move it at any part of the operation. By this I mean that not over two or three pounds of force are required, yet the table, although of comparatively light

construction, may weigh around twenty pounds with its various hinger and rods.

The table top is made of lumber a full anch thick when dressed. The boards are glued at the joints and are held together by four steel rods 5/16 in in diameter. The heads and nuts are, of course, suck in and plugged over. This makes the top look like one flat prece

From the diagrams it will be seen that part of the table folds upwards and the main portion just fills the walt opening which is 42 by 27 1/2 in. The two benches then fold against the two doors on the inside so that, when the doors are closed, all parts are in that space and within a depth of only 51% in. The advantage of this folding set is that it is easier to clean up when the table and benches are out of the way, and it gives extra room to the katchen.-P G BERNHOLE,

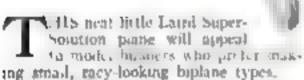


The breakfast mock open and closed, and drawings to show method of folding and how e beach tops slide behind the doors. The design may be modified to suit the space

A Racy Little Biplane

The scale of the model in comparison with the full size Laird plane to A in counts 1 it. The wing agreed in 9 n. and the round lust age is only 6 to 10 ag.

DONALD W. CLARK'S latest model



The astage can be carved from a section of 136 in, diameter curtain pole, 6 in, long, If no lathe is of hand, the front end can be shaped with knife chisel, and sandpaper. Saw the tail slots



all ding upper wing into position. The cocky a cowing is good on the fact age and nucched out

before carving. Use a fine coping saw to cut the cockpit and the recesses for the upper and lower wings, which are to be fastened with small brads

The motor cylinders may easily be represented by using 3, 16 in diameter bolts. These must be divided in half lengthwise and also cut up into pieces 34 in, long. Center the crank case in the recess in the front of the fusclage block, and tement or glue the cylinder pieces flat side in, to form the cylinder circle. You will not be able to get in

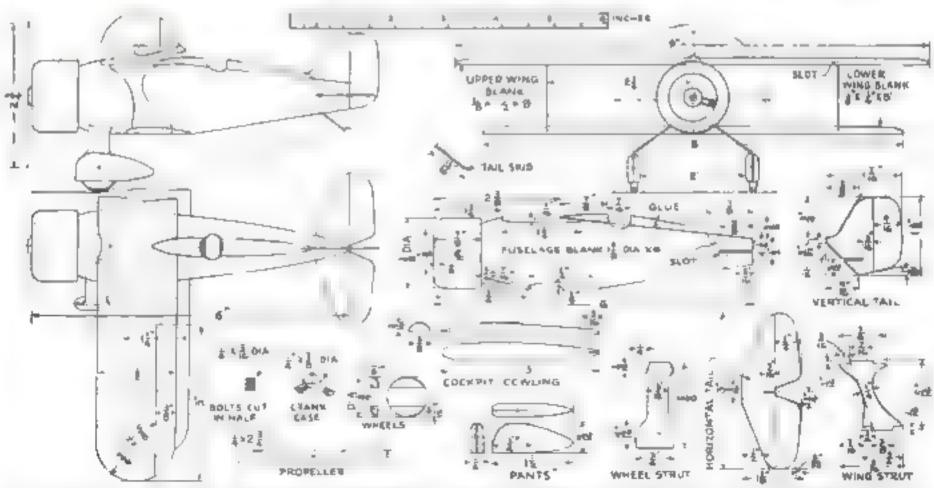


more than six or seven cylinders (unless you use smader bolts), but the effect is substently realists

that the tail units from thin metal or 1 32-in, fiber. These are held in place with one brad in the vertical tail. Make the landing gear struts of 1 32 in, event and bend as shown. These slip in a since in the "pants" and are held with brads and their upper ends fit slots in the fuse lage. Make the wheels of wood and glue them to the bottom of the "pants."

Cut the wings from pine, plane to shape, and finish with sandpaper. Make stors in the bottom of the upper wing and in the top of the lower wing to take the wing strois, which are made of thin metal or fiber. Cut the propeller from a metal blank 14 by 334 in, and file to shape.

It has special models would you tike to have added to Mr. Clark's series?



The entembly views and drawings of all parts. Any dimensions not given can be estimated by referring to the scale. The model looks well if carefully painted in two colors, as follows, wings, wing strute, and horizontal tail, bull, fuse age, vertical tail, wheel pants, and strute pea great.

IN EVERY home workshop, especially if it happens to be located in the basement, there is a real need for a practical way to protect fine tools, partly completed models, and delicate apparatus from dust The two cabinets shown at the right are designed for this purpose. They are easy to make and cost little for materials

After you have decided what size cabinet will best suit your purpose, cut a base from a 1 or 114 in thick board Make the base about 2 in, bigger in both directions than the clearance you want

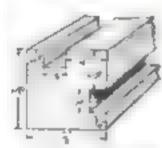
inside the cabinet

Now take a 38 in, thick board and rip off four square strips in length equal to the necessary clearance in height. Set up the dade head on your circular saw for a groove 34 in wide and 3/16 in, deep (or adjust a suitable hand plane for the same type of cut). Adjust the rip guide on the



saw so that you can groove the square straps with one edge of the cut coming on the center bue of that side of the strip. Cut rabbets on two adjacent faces of each square strip so that the grooves





Detail of corner pour and at left the door al ghtly pulled up to show how joint along the top edge is fitted

are each half the width of the strip from the corner between them as shown in the accompanying deawing

Next set one of the calchered strips on the corner of the base with the grooved faces toward the

adjacent corners and lightly trace the outline of the end of the strip on the baseboard. Repeat at the other three corners. Select a drill that will just give clearance to the shank of a No. 8 wood screw and

drill down through the baseboard at the point within each outline where the hold will be well inside the pencil mark. Countersink the holes on the bottom of the baseboard and attach the upright

Plywood panels, cut to fit in the grooves, form the four side walls of the cabinet. Now look at the large photograph again and note the small aquare pieces that are bailed in the corners of the joints between the side and back panels and the baseboard. Similar pieces cover the joints between the side walls and the plywood top

By studying the large illustration in connection with the other photograph, you will see more clearly how the dust excluding front slide is made. - A P L,

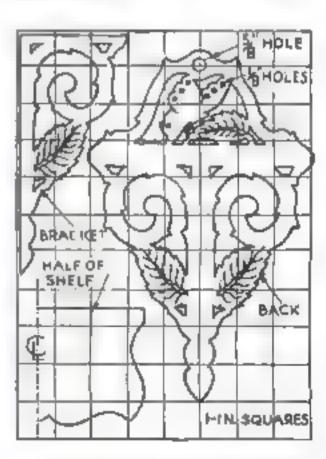
JIG-SAWED BUTTERFLY WALL BRACKETS

WELL-DESIGNED wall brackets relieve the bare look of an otherwise empty wall space. A pair of them may be used to special advantage on opposite sides of a freplace or entrance archway, or on each side of an alcove or other nook.

A jig-sawed butterfly design is illustrated. Three-ply veneer 14 by 1014 by 13 in, or a similar piece of any 14 in, thick wood will be sufficient for one bracket. Copy the design on a sheet of cardboard which has been divided into 1-in, squares. Cut out the pattern and trace the design on the wood. Cut the bracket with a hand coping or fret saw or on a power scroll saw, keeping slightly outside of the lines. Then file to the lines. Sandpaper all parts with Nos 1 52 and 0 sandpaper and assemble with fain. wire brads.

The brackets may be lacquered or enameled to give a touch of bright color in a dull or dark room. If enamel is to be used, first brush on one thin coat of white shellar Sandpaper this thoroughly with No. 0 sandpaper, and apply one coat of flat paint followed by two coats of enamel of the desired color Rub the last coat with pursice stone and water For a lacquered finish, two coats of lacquer will be sufficient.—ANTHONY T. PUSCIENA.



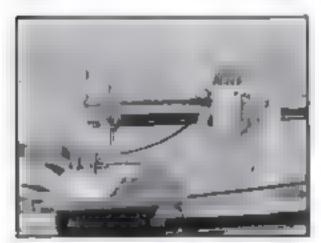






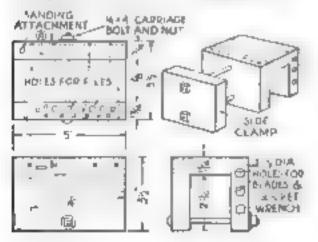
FOR USE IN DARK

A CHEAP fountain pen flash light and two rusher bands are all that are required to make it easy to drive or remove screws in dark corners where the slots in the heads cannot otherwise be seen. Place the barrel of the flash light on the shank of the screw driver and hold it with the rubber bands as shown above. Then snap the button in the end of the flash light and see what a great aid this will be when working in places that are budly lighted.—George E. Kilparnick, Ja.



CONVENIENT TOOL RACK CLAMPS ON JIG SAW

FROM scraps of wood, a convenient fig-saw tool rack can be made. Build an inverted "U" of a width suitable for stradding the frame of the saw, if it is not of the rocker arm type, or make it of any convenient dimensions for clamping at the side. The rack shown above was drilled in the upper edge of one side to hold files, while 34-in, holes were made in the end of the other side, sloping down, for blages and a wrench.—E.L.

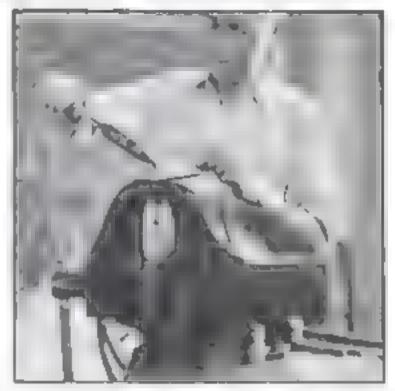


VISE JAWS LINED TO AID IN SOLDERING

WHENEVER it is necessary to hold parts made of light metal in a vise to be soldered. the laws conduct the beat away so rapidly that the solder tends to "freeze" before penetrating far enough into the I not to make a good job. A simple way of getting around this trouble is to obtain two squares of sheet asbestos packing at least I 16 in, thick and as wide as the vise jaws, and bend them L-shaped with the short leg as long as the depth of the jaw face. Scrap pieces of asbestos packing or gasket material can be had for little or nothing at any steam fifter's or plumbing shop.

These jaw liners are dropped into place before putting the work into the vise, and are so effective in conserving heat that the joints may readily be sweated together with their aid

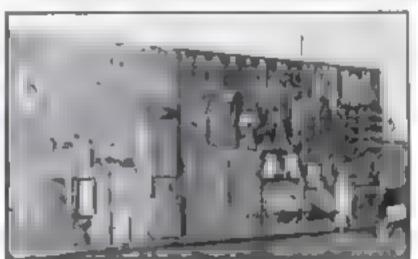
in cases when it would otherwise be necessary to use a blowforch. The asbeston is also yielding enough to reduce the likelihood of distorting or marring the



Ashestes liners, bent L-shaped, are placed over the vine jaws to prevent the heat from being carried away

parts with the vise jaws. It serves the same purpose, indeed, as if special soft metal jaws were used, besides conserving the heat.—Elton Sterrett.

RECESSED PANELS KEEP TOOLS ORDERLY



Unlike ordinary tool boards, this one contains gauged-out treeses for the tools so that they cannot be mapiaced

Paset tool boards for the wall of a shop with the outlines of the tools painted on them are well known but they have one drawback. The wrong tool may be placed in a certain spot, regardless of

This is impossible on the board. This is impossible on the board filustrated because each tool is inset in a closely fitting recess and most of them go in flush with the surface.

The board consists of two 4 by 6 ft. sections, each with a 1 in. projecting border. On this board are fastened, with wood screws, panels from 1 to 2 in. thick, on which the outlines of the tools have been marked and chiseled out. To aid the eye in quickly placing tools, the

quickly placing tools, the background of each niche is painted white. Panels are added to the board as tools accumulate. Thus is a most flexible method, since the individual panels may be shifted if necessary.—J. C. C

A QUICK GROWING DEPRESSION GARDEN

Various mixtures are used in making so-called "depression" gardens of the type illustrated, but I have found the following more effective than saft and blung alone or other combinations: 4 tablespoons of saft and 2 tablespoons each of air-slaked lime, cornstarch, and blung. Mix the three dry materials, then add the bluing and enough water to give a liquid mixture. This alone will "grow" into a beautiful snow effect, but a little fruit coloring can be added where desired.

The garden shown was made in a tintray I ft, wade, 2 ft, long, and I in, deep. Plain ashes and a few small clinkers gave the hilly effect, and a few bare branches and cedar limbs were stuck into the ashes after being dipped into the solution. The house was built from acraps and the roof



This realist c snow scene was "grown" with salt, air-alabed lime, cornstarch, and bluing

covered liberally with the liquid. The fence was made from a strip of ½-in hardware mesh. The little automobile is a toy.—Carl G. Exich

What the amateur photographer needs to know about

Camera Tripods and Supports

By FREDERICK D. RYDER, JR.



Four amateur tripode. A (a of light wood con-processor & a standard tubular ing variety. C. the anap type with add arecting, folded metal lage, D, an aspec ally compact tubular model. Type D can be carried in the hip packet, as shown

F YOU were made of cast iron and had a clamp at every joint, you could stick out your arm, with your camera pointing in the right direction, righten a few thumbscrews, and take fine time ex-

Actually, when we try to stand perfectly still, our bodies sway back

and forth, our arms wabble, and our poor light, camp scenes in beavy woods, hands tremble. That's why a commonly and so on, all call for relatively long accepted rule is never to make a slower exposures. Even when it is technically exposure with a band-held camera than about a twenty-fifth of a second, Provided you hold reasonably still and don't give a sudden jeck just as you press the button, the camera won't be swayed enough during a twenty-fifth of a second to make the picture appreciably fussy

Of course, there are people with such steady nerves and muscles that they can get away with tenth- or even fifth-second exposures when conditions are favorable firm ground on which to stand and no wind blowing).

No matter what kind of camera you



the leas may be, you need some sort of firm support to get good results from many of the pictures you will want to take Interiors, outdoor shots in

possible to take a snapshot, better results usually can be obtained by using a smaller lens opening and a longer exposure

Choosing a suitable tripod or other portable support depends both on the sure and weight of your camera and your own personal ideas as to how much extra weight and bulk you are willing to carry in order to be prepared for all picture possibilities

The strength rigidity and durability of a tripod, if it is properly designed, are roughly as proportion to its weight and bulk when folded. Other factors of im-



You can guin a couple of feet on neerise shots by folding one leg of your tripod and backing it against the wall

portance are the beight when fully extended and whether or not there as any provision for adjusting the

Four typical amateur tripods are shown ready for use and folded for carrying. A is about the lightest construction possible in wood. Only the end section is

adjustable for length, B is a popular tubular-steel tripod that will support the camera at various heights from the ground, depending on how many sections of the legs are pulled out. C is a snap type, the legs automatically unfolding. section by section, when a release is pressed. The legs are of U-shaped or channel section. It has no swivel top nor can the length of the legs be rhanged D is a tubular brass leg triped designed for extreme portability. It can be carried in its leather case in the hip pocket as shown in one of the photographs. In the same view a type B tripod is shown being carned by hand

Types B and D, being made in the some way, afford an interesting comparison. Type D is extremely compact, but is not nearly so rigid in use nor so strong

and durable as type B.

It would obviously be feelish to expect the hip tripod to give satisfactory service. with a 31/4 by 41/4-in, or larger camera It is suitable for use only wan lit le cameras of 2/4 by 31/4 in size or smaller,

No matter which expe of tripod you buy remember that it is designed for use as a camera (Continued on page 79)

Electric Eye Sees and Corrects Movie Mistakes!

The movie film you send to an Eastman station for finishing is first developed as an ordinary negative and then changed to a positive. During the process, an electric eye scans every inch of the film for exposure errors. And for Ciné-Kodak Eight Film, with its double row of images, there are two eyes-one watching each row.

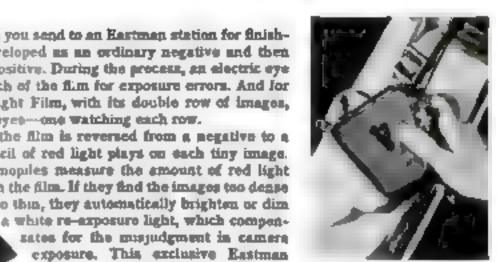
just before the film is reversed from a negative to a positive, a pencil of red light plays on each tiny image. Sensitive thermopiles measure the amount of red light passing through the film. If they find the images too dense or too thin, they automatically brighten or dim-

user of Ciné-Kodak Film.

sates for the masjudgment in camera exposure. This exclusive Eastman feature saves thany an under- or overexposed econe and gives you finished movies of uniform quality on the acreen, it offers a much wider latitude of light conditions under which you can make good pictures, Eastman Snishing stations all over the world provide this special processing service for every

TAKE IT ALONG Cind-Radak Zight dagen't take up much amon-yet st's a fullfledged movie camers. It gives you the low-down on your goldand form-takes clear, sparbling movies of your autings. A Balas film makes an to an ecopes -less than les a shot And the

comera coaté only Ban.50.



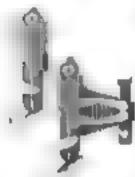
THE NEGATIVE ABOVE

A magnified view of Cine Kodak Bight Firm an over-dente wene on one half and an ave this scene on the o her Ir sup a the even ric eye to appear his difference, or ad up to re-represent accordingly

AT RIGHT-THE RESULT

Both aceges have been saved and made ato ening y clear possions. The expensive monthless have been naturalizedly compensated for-

OPENS LIKE A JACK-IN-THE-BOX



Jiffy Kodak, steeplest folding comern ever devised, fulfills the need. for a quick-action comers of kees. picture-making ability. Touch a hutton- POP 44 spens. Twock another -CLICK -it anapa the parture. He amort appearance spakes you proud to carry it. The quanty of its pictures making you proud to show them. Jiffy Rodalt Big-16 (24) 2 441. By 50. July-Kodak Str-10 (1 & 2 #141, \$6.75.



Ciné-Kodak Special is a real professional-type 16mm. movie camera, Precision-made, custombuilt, a camera of unparalleled ability. It puts many of the tricks and effects of Hollywood within the advanced ameteur's reach. It simplifies slowmotion analyses and other industrial studies. Double exposure — slow motion — dissolves - feder variable shutter—masks—interchangeable film chambers-reflex finder focusingvariable speed-spring motor drive or hand crank-double lens turret. Write for Ciné-Kodak Special Book for complete, comprehensive facts,

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Here you ever finished your own tongshots? It's a functionting bobby. Kodak Darkroom Outilt No. 1 contamt everything you need for fast, easy developing and printing. Includes safelight hamp, three exameled trays, developing and dring chemicals, I-ounce graduate, stirring cod, thermometer, developing clipt, auto-mark printing frame, and complete instructions. May be used in any room. which can be darkened. Cost, only \$5.75.

> If it isn't an Eastman, it isn't a Kodak



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Street

City

State

Centering Long Bars IN THE LATHE

By
Thomas W. Arnold

Long bars can be centered with a high degree
of accuracy if you know
how to use the steady
rest to best advantage.
Once it has been set
properly, a true center
beating can be cut in
the end of the bar with
a hill-round 60 deg centering too. The photograph below above the
center he e after the centering tool is backed out

been bored sufficiently large—plenty of bearing surface on the centers is desirable—back off the centering tool and replace it with a small twist drill. Feed this in till you have a hole about 1/4 in, deep at he bottom of the V-shaped depression made by the centering tool. This will provide cleazance for the point of the center and also serve as a reservoir for lubricate.

This method, if carefully carried out, will center a good piece of cold-rolled shafting so accurately that a dial indicator will tarely show more than a couple of ten-shousandths of an inch error

On bare small enough to pass through the hole in the headstock spindle, the same method can be used with the end of the bar projecting from the chuck. Any error in the trueness of the chuck will, of course, he reproduced in the centering of

T HAS been said that accurate centering is half the job in all lathe work. This applies with special force to the turning or threading of long bars.

Suppose, for example, the piece you need for the machine you are building must be over 1/2 ft, long, with 6 in, or more of one end threaded and 2 in, of the other end turned down to a smaller diameter. Assume that the diameter is to be 1/4 in, and that the bar is to be a rotating part, and therefore must run true.

An amateur would be likely to use 1-in cold-ro-led shafting. He would mark the centers with dividers or in some other customary way, centerpunch them, and use a combination drill and centering too to drill them. A much more accurate way is shown in the accompanying photographs

First, clamp the end of the bar in the aniversal chuck with which most of the lather used by amateurs are fitted. Then place the steady rest in position so that its jaws come close to the end of the bar. Now raise the two lower jaws of the rest till they touch the bar. Rotate the lathe spindle by hand and see if the bar has a tendency to whip up off the steady-rest jaws. If he bar is reasonably straight and the chuck is fairly true. It will not. If it does not the upper jaw into centact with the bar.

Next move a facing tool in the tool post so that its point just touches the end of the bar at what appears to be its center when it is revolving slowly. This will cause a tiny circle to be scratched around the true center of the bar

Back off the upper steady rest Jaw, push

the tailstock dead center up till it nearly touches the bar and adjust the lower steady-rest jaws till the center of the tiny carele is equarely in line with the point of the dead center. Now set the upper steady-rest jaw firmly but not too tight y, against the bar

Apply a bit of lubricant to the steadyrest taws—graphite grease is excellent
for this purpose—and you are ready to
fice he end of the bar with the facing
tool and then bore a 60 deg angle center
hole with a half round 60-deg centering
tool. This is much more accurate than
using an ordinary combination drill and
centering tool. Feed very slowly, and if
there is the slightest tendency to wabble,
turn the flat of the point to a different
position and repeat till you find a setting
where the point will have no sidewise motion whatever as it bores its way into the
end of the long bar

After the angular bearing surface has

the bar, and as few universal or scroll type chacks are absolutely true, the steadyrest method is best if you want really accurate centers

in an article to Jollow, Mr. Arnold will show how to overcome the baffing and unusual problems excountered in turning and screw-cutting long bars

BATTLESHIP LINOLEUM POLISHES METAL

A scrap of old battleship linoieum makes a fast cutting and excellent polishing disk. I discovered this when I made a linoieum block cut recently for printing rifle targets. I turned out the rings and the bull s-eye on a lathe and was surprised to find that the binoleum cut high-speed steel nearly as fast as an emery wheel and left a beautiful polish. No scratches were visible to the naked eye.—M. A. C

DURABLE

Magazine q Rack

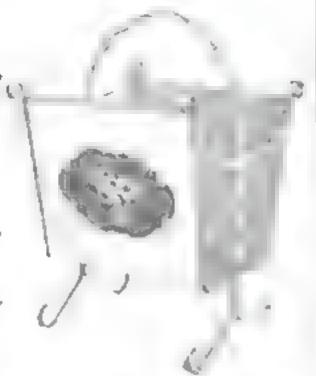
MADE FROM METAL AT LOW COST

By Lee M. Klinefelter

HIS magazine rack is roomy, durable, and good-looking, does not spill mag at her all over the floor, and, best of all, can be made at little cost with the tools found in the average home shop

found in the average home shop

The frame requires about 20 ft. of 1/2 by
1/4 in soft steel. All the bends and twists
are made cold, the twists being made before
the bends. The twisting is done by clamping
one end of the steel in the vise and twisting
with a wrench at the other end. If a piece
of 3/2-in, pipe of the proper length is alipped
over the the steel before twisting, as shown
in the photograph below, all danger of kink
ing the twisted parts will be eliminated. The
sharp bends are made with a hammer over
the edge of the vise, and the curves are bent
over a piece of pipe clamped in the vise.



The empleted magazine rack. A transfer decoration on each side adds to its beauty

The galvanued from liner may be bent by clamping the metal between two boards at the benching line and bending it over with the edge of another board. Care should be be taken to avoid hammer marks. If dested, you may have the liner bent up on a brake by the tinner or sheet metal worker from whom you buy the material. This will save time, insure smooth bends, and add but little to the cost

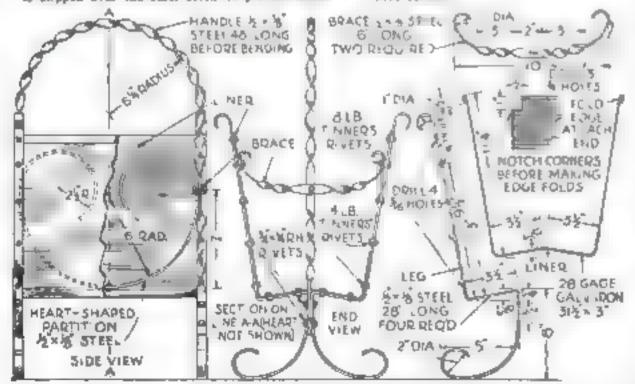
The location of the rivet holes and other details are shown in the drawings. Drill 3 16-

in, holes for the 4 lb. tinners' rivets and 14 in, holes for the 8 lb. rivels. A separate detail of the handle has not been given as its exact shape is shown on the side assembly view. Its lower ends are riveled firmly between the less with two rivets at each end, as made clear in the end view.

Any harmonious color combination may be used to unabine the rack. Quick, drying enamel looks and wears wer. The use of transfer decorations in the sides will add much to the attractiveness of the finished piece. They may be obtained from paint dealers and art supply houses at small cost. Since the method of application varies, directions printed on the back of the transfers should be followed for lest results.



While the rw are are being made, a length of pipe to supped over the sizel stock to prevent kinks



fide and end views of the rack and details showing how the four legs, the two braces, and the sheet metal liner are bent. The handle can be laid out without difficulty from the two assembly views



Maybe you have wondered-

Why your bouse becomes so unbearably hot those summer days—and why that stifling heat tingers in your bedcome all night.

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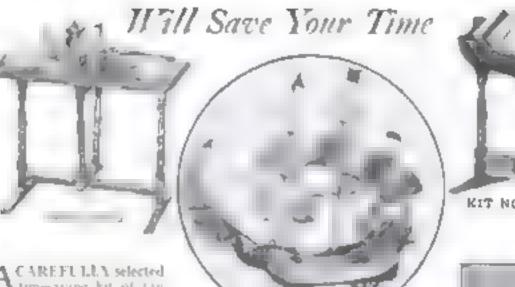
They re speed-demons that crash into the mark with a pile-driver smash, 25% more average speed-in some sizes 35%. 50% more average power - in some sizes 80%. The only .22's cased in brass like military cartridges -- greater strength. You will be asconished at their supreme sccumcy.

K conborn carts ages, regular and Hi-Speed, in the green boxes, are for sale everywhere. Be sure to get them. Weren for a descriptive folder Remington Arms Company, Inc., Originators of Kleinbore Ammunican, Bridgepott, Conn.





Our Construction Kits



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tam a billeabetban gale o Receive is the latest audition to the construction kits offered by the Popular Science Homecraft

The new kit, marked G in the list below, contains a plywood centerboard sawed to shape and two phain white pine side blocks for making the hull, all the necessary thin plywood, chair caning spline, hard wood for small fittines, celluloid, dowels, ware ris ging cord, sailcloth, silk, beads, bruds, pins, escutch con pins-in fact everything but glue and paints Le in aclaten, you wish the two misso side blocks of the bull shaped and inshed, order the kit marked 66

The other kits available are also shown in the following list leach is at c repulsical by metrustions or blueprints.

A. Whating ship model H'andreer, All the mw

materials-wood, wire, fishing line, cham, celluloid, and everything but the paints, together with Blueprints Nos. 151, 152, 153. and 154. The hull is 301/2 in, long \$6.90

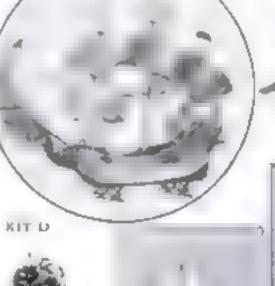
AA. Same with hull lifts sawed D. Spanish galleon shap monel 24 in long All the raw materia's act out guints), Blueprints Nos 46 and 47 and a booklet. 0 45

6 95 DD Same with bull blocks shaped E. Battleship model, U. S. S. Terra, 3 ft. long. All the raw materials (except paints) and Blueprints Nos. 197 (a 200...... 6.95

EE. Same with hull hits sawed .. 7.45 P Liner Manhattan, All raw materials tencept paints) for a simplified miniature model 12 in. long, and Blueprint No. 204., 1,00

G. Elizabethan galleon Revenge. All raw materials (except paints) for a model 25 in. long, and Blueprints Nus. 206 to 209 . 6.73







KIT NO. 4



KAT F-Materials for \$2 in, model of Menhatran

GG. Same with hull blocks shaped . 7.25 No. 2. Solid mahogany tray-top table 23 in, high with a 15 in diameter top Reasty to assemble

No 3 Till top coffee lable in selected maple with top 40 by 28 in , and 23 and high Ready to assemble

No. 4 Sould mahugany book trough 27 , in long 91, in wise and 2454 in high over a Ready to assemble

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CAMERA TRIPODS AND SUPPORTS

C. notniged for at page 14.

support and should not be considered a substitute for a crowbar, hammer, or other apparatus on autoor camping trips

Tripods have three less so they wall hold the camera firmly in a level position even on rough growns. By changing the position of the legs, it is possible to point the camera slightly apward or downward. Often, however, you will want to point the lens down or up more than the leg movement will permit-This is especially true of the home workship enthusiast who wishes to take deta is from various angles of

the things he has but

har such work you need an acressory known as a tiptop. The photograph at the end of this article shows three types, A is a conventional ball and socket tiptop suitable for use with light cameras. B is a swing-table type that is stronger costs more and can be used with cameras up to the 4 by 5-in size C is especially useful. It is built beavier than it and, in adminion, the ower portion is arranged in such a way that the unit will clamp the comera la any desired position to any sustably placed flat projection It completely clim nates the need for a tripod in many cases. The photograph at the right shows an amateur camera being clamped with the aid of this device.

Tiptop D is a special type of camera clamp with a screw on a ball socket mounted on a pair of powerful, apring-operated, toothed jaws. It is especially useful on camping trips It will held firmly to the bark of a tree and gets a building grip on any convenient branch or tent pole. If you do not wish to burden yourself with a triped, then tiptop C, plus a chair will support the camera for bome interiors, and D certainly should be a part of

your camp and outing equipment

Do not assume, because you have placed your camera on a tripod, that pictures showing the fuzz-ness of motion are not possible. No matter how firm the Iripod may be, remember that it has only three slender less and that the camers will have a tendency to swing back and forth like a pendulum each time you jar it, in setting the shotter, for example. This is particularly true when the camera is on a

tiptop and is considerably out of balance. Always let the camera settle for at least fifteen seconds after the last time you touch It before you press the release to make the exposure. Take care, too, that the shutter release is bent in the furm of a loose curve so that the motion of your fingers cannot be

transmitted to the camera

Another common source of trouble and fuzzy pictures is floor movement. If you walk across the floor during a long exposure, the shifting of your weight may cause a floor



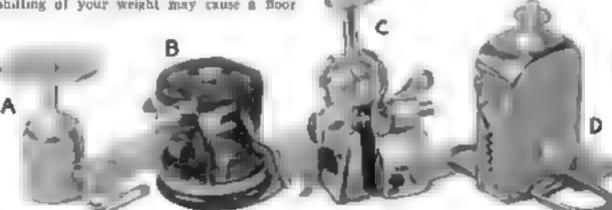
Toking an interior view with the camera fastened to a chair by means of the tiptop shows at C below

board under a tripod leg to raue or lower a int, and then you will wonder why objects in the picture show traces of double outlines. Stand still and have everyone else in the coomstand still while you are making those exposures unless you are working on a bravy concrete floor

Whenever there is any doubt about the steadiness of the tripod setting-and always when you are taking a picture with the camera on a liptop-make the actual exposure by means of a black card beid a few nches from the lens. Even pushing the shutter resease may cause sheht camera movement

The steadiness of any terpod is at a maximum when the less are spread well apart. On wooden floors, try to catch the point of each leg in a crack between two boards so that there will be less chance of slipping. When you are cramped for room, the trick shown in the upper photograph on page 74 comes in harroy. Using two tegs and the wall in this way will allow you to get another couple of feet away from your subject so as to oclude more of it.

If there is any doubt about the steadiness of the tripod setting, or there are small children playing pround, stay within arm's reach of the camera and keep your eye on it!



A is a tiptop for light cameras. B is a swing-table type for heavier models, C is a combination tiptop and camera clamp, and D is a clamp for fastening a camera to a tree ac branch

FREE PLANS for THIS BOAT IRWIN'S FOR the benefit of homecraftsmen who would like to make their own row boat for this summer a vacation, we offer absolutely free a complete set of place which make the job simple. It is not necessary that you be An expert to make this boatbut It is necessary that you use good tools no matter what you are making. The Irwin Auger Bit Company has been making quality wood-boring tools for craftsmen for 47 years. The new Irwis" Bluwio has everything that can be put into a bit.

It has a cutting head so constructed and best-treated that it will go through the toughest of wood like butter-it is rugged-durable and rustresisting. Runyour fingers over its sating finish-try and bend ri with both hands and you will know you are examining the finest tool that money can buy.

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complete set of working drawings of the row boat pictured above. "Irwin" Bluwin Bies for sale in all sizes by your hardware dealer, or write direct.

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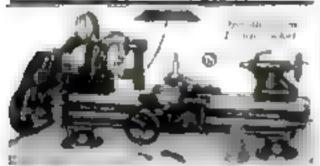


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HOME WORKSHOP BLUEPRINTS

New projects are marked with an asterisk ."

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here are two or more blueprints in the comskie set II the letter R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by a special reprint of it distructions originally published in the magazine. If you do not wish this reprint, outet the letter "R" from your order and deduct 25 cents from the price given. Reprints lone are sold for 25 cents each

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CIRCUIT BREAKER BUILT FOR MODEL RAILWAY

THE simplest way to protect the wiring of your model railway from the effects of a short circuit is to install an ordinary fuse block for taking household type plug fuses. A 5- or 10-ampere fuse will handle the load of a small model railway, and 15ampere fuses are large enough for an etaborate installation using two or more locomotives. The only trouble with this system is that hearly every devariment means a burned-out fuse, and fuses cost money

The accompanying illustration shows a Simple home-built circuit breaker It can be made up trum pieces found in most home workshop scrap boxes. The physical design of a circuit breaker can be varied in many



When a short circuit courses a heavy current to flow through the cost the armsture pulle down the irigger and the swetch eprings open

ways, but in theory it is always the same There is a switch that is held closed against a spring by a trigger to which is attached the armature of a magnet. The coll of the latter is wound with only a few furns of heavy wire This con is connected into one of the wires that feeds current to the track. The coll has so few turns of wire that the flow of current needed to operate the locomotives has no effect on it, but when a short circuit occurs, the magnet attracts the armature. This pulls the trieger and the switch flies open, thus breaking the circuit

In the circuit breaker diustrated, a coil spring was fastened under the blade of an old knife switch. A piece of sheet metal was cut to shown so that one end books over the knife blade when it is pushed down to the raised position. The other end of this sever is linked to a short piece of tron rod. which is pulled down into a brass tube when the heavy current from a short circuit flows through the insulated coil that is wound around the lube

The circuit breaker may be adjusted so that it was bold for the normal load and trip off on a short circuit either by changand the tension of the spring that holds the trigger in engagement with the switch blade or by changing the number of turns of wire wound around the brass tube. Reducing the tension of the spring or increasing the number of turns of wire makes the circuit breaker more sensitive and more responsive to overleads .-- FRANK E. CREST, JR.

KEEPING MODEL RAILWAY FITTINGS IN SCALE

IF YOU want to start a hot argument I amone a group of model milway fars, all you have to do is bring up the subject of scale dimensions. A number will maintaus that streking to scale in other words, making each part of a model an exact scale reduction of the prototype—is of vital im-

As a mailer of fact, every ardent advocate of strictly scale model making has to compromise on more dimensions than he cares to think about. In (Continued on page 83)

FREE advice to Brides!



TERE'S a way to avoid getting into hot water with your husband. Most husband troubles, like most hot water troubles, are caused by faulty paper.

"The symptoms of a faulty pipe are black clouds of foul-smelling smoke spreading through the new

home like tidal waves.

"No need of it, girls. Get your husband started on Sir Walter Raleigh Smoking Tobacco in a well-kept pipe, and you'll never have anything but happiness. Neither will he. For this tobacco is a mild, satisfying mixture of rare Kentucky Burleys that delights both sexes. I bring it to you fresh, wrapped in gold foil. Here's a book I've written about keeping a pipe. I might have called it, 'How to Keep a Husband.' It's valuable, and it's free to brides (and everyone else)."

Brewn & Williamon Tobecco Corporation Louisville, Kentucky, Dopt. Y-57



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UT holes into the masonry with a cold cheel, insert boits with heads in to form studs, and tamp remaining open spaces full of Smooth-On No. 1 Let the Smooth-On harden, then slip the brackets, cleats or uprights over the stude and fasten with buts or nuts f and washers. A 14 m. bult set this way holds a man's weight without basenian. Use this method to anchor cellar shelves, portitions, walk cohinets, etc. Makes a strong permanently hight connection that meets every need

Use Smooth-On No. 1 also to stop leaks, Seuls joints and cracks in pipes, boilers, radia-

to be etc. Tightens louse hancres, tocks hanges, casters hicks stems e stroped no boli and screws hold Stops leaks in auto radiators, hose connections, crucked water jackets and gear cases, oil and gasone lines, keeps nuts, labricutor connections, hub cars and wood screws from comng loose, maker dash supports tight and proof against rathle

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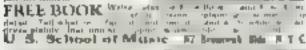
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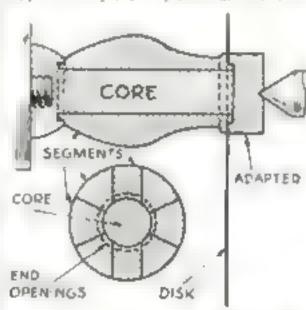


Hints on Difficult Metal Spinning

BY HERBERT WOOLSEY

SOME articles spun from sheet metal look as if they had been shaped over sectional forms such as were described in the preceding article in this series (P.S.M., June '33, p. 76), but in reality they were made by a different method. If you recall the ash-tray job described in a previous article (P.S.M., Apr. 33), p 6, you w remember that the bortom flance was turned over while the work was held in a hollow wood chuck. By a similar method, shallow bowls or pans with turned-in sides can be made, and other objects of similar nature produced. However, for the productinn of a number of pieces of exactly the same -hape, nothing can replace a sectional chuck

Hollow articles having openings smaller than the maximum diameter of their in cross on be soun without the use of any inside support if they are very small in site. Thus



Chuck dangered for work open as both ends and of greater diameter in the central part

a constricted ring can be spon amound a small closed exhiber if the closed end is adopted to project beyond the end of a core. The smallness of size produces a stiffness that makes this possible.

There is another type of arctional chuck that can be used without previously forming the work on a one-piece chuck. This type is employed for making articles open at both ends, such as a hollow knot that can be sliasong a god or tube

The parts making up such a sectional churk are formed with a projecting collar on each end. That at one end fits its a proove around the core, while that at the other cod passethrough a hole to the center of the blank, and in thus held securely enough to permit span ning, as shown in the accompanying diagram. Further security is obtained by using a steel tock-center button so shaped that it he was the projecting collar beyond the blank

Another form of spinning that may puzzle the novice is the making of a tubular object open at both ends and with the center smaller in diameter than the ends. The rims on which some attolage tires are mounted take such The chuck used in such spinning can be made to separate at the mobile, so that each half will come out of its end of the Work The piece is spun from a flat disk, the center being cut away subsequently to open one end-

The photo in the next column shows a form of the type which is used in producing the constructed part of a lamp-post knob The remainder or tip of the knob is spun on forms similar to those employed in making spheres (PSM., May 35, p. 60), and is soldered to the lower piece. The two lefthand pieces of the churk shown were made of aluminum, while the form over which the tip is spun is of steel.

This use of steel and aluminum or other



The first two proces are part of a sectional chuck on which the lower part of the knob shown at the light was made. The top of the knob was spun on the pointed form. he third piece, and brased to the lower section.

metal is not entirely a matter of tasts or availaboty of materials. Soft metals can be used where curves are centre and the metalis not drawn excessively in spanning. However, when sharp changes in contour are made, or pointed objects produced as in the case if the lamp-post knob, steel is necessary besuse of its greater strength and resistance

Spinning is not confined entirely to round objects, for some articles you encounter almost very day are oval in shape, yet were prouelt products, however, requires a special churk that is beyond the resources of the

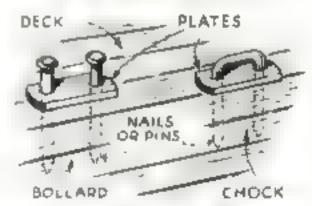
average small shop-

The production of rolled edges or beadings often involves the use of special equipment Nevertheless, by employing a tool that consuts of pulley with a concave groove, mounted in a slotted steel hundle, any spinner can turn edges over to a nicely. Simply start the metapossible. Then use the pulley wheel to "tuck it in." Other whreled tools are used for special work, such as the spinning of grooves.

The subject of somming is too extensive to be tovered completely in so brief a manner as up this series. An effort has been made in this and the four preceding acticles to introduce the povice to the more important details of the art. Ingenuity and experience can be depended upon to lead the way to more com-

picte masters

CHOCKS AND BOLLARDS FOR SHIP MODELS



Two sogges one for making small chocks and be lards from fla places and pine or he is

time as and bollards for this models are easily made by cutting cardboard or thin metal to the proper shape, gaing or cementing it to the deck, and driving pins or nale in as shown. If bruss or other metal is used, boles will have to be drilled for the pins, and the plus may be soldered to the plate. In the case of bollands it as advisable to use escutchcon pins rather than common pins because the heads are a better shape.-R J H

Subscribers are requested to nowly us of change of address four weeks in advance of the next publication date. Piease be sure to . c both old and new address



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Make money breeding I'R Boyal DOK squabs Self the best of the period of the ng Mile begind oile up in which Altrack is now for it of free the same back some four in it is not been a same of the same of



Tricks With Electricity

Make things upin, hour, hich bear, cheer short. Buch, night by allectricity blake lights obey when who does movel as brick phis floating a may, again a complex wall break acatematy, graculcal devices. Sook to be bowlet do 200 alumin with the wells A.C. Footpaté 51

CUTTING & BONS, THE SI, CAMPOBLE CALV.



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Free Short Many Catalog 8-3. Kerrisen Budle Co., 142 Liberty Street, New York City

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Always mention Popt LAR Science MONTHLY when answering advertisements in this magazine.

KEEPING MODEL RAILWAY FITTINGS IN SCALE

(Continued from page \$1)



Model signboard built to the correct scale. The picture was taken from an advertisement

"O" gage, for example, making a steam tocomotive absolutely to scale would be a task to difficult that only a man equally expert in diesinking, tool making, and in the building of time watches could hope to succeed. On the other hand, all model makers should work to the correct dimensions whenever it is possible

Beginners are specially likely to overlook this point. They often make things way out of scale when it would be just an easy to make them the correct size. Telegraph poles made of \$5-in, downl rots instead of 1/2 or 3 16 in in diameter are an example

This point is well illustrated in the photograph above. It is common practice to make model a subpards to decorate the right of way, but they are often so chamsy and heavy that all realism is lost. This sign is an ail vertisement cut from a magazine Around the edges have been glued strips of wood I lo in, thick by slightly less than 14 in wide, set edgewise. The vertical strips project downward to form legs. Two addilional pieces were cut off at an angle of 60 deg, and glued to the back to form supports. The same construction will work out equally well if you use heavy cardboard cut in steps, provided you shellar the cardboard framework, legs, and supports so they won't sag. How much less attractive this signboard would be if it were framed with heavier strips and had thick, stumpy lens and supports?

Of charge the more claborate the modelespecially if it has moving parts—the more difficult it is to stick to scale. The photograph below, however, shows what can be done along these lines with the building of model stanals. Electric light bulbs no larger than a small pea were used, and the position light contains seven of them .- TWA



Even as forricate signal apparatus as the can be kept very nearly to scale proportions



10,000 Skippers said "YES, we use PLASTIC WOOD"

It sounded like 10,000 - the answers came so fast. It all started when the bost said. "Write an ad about Plastic Wood for boat repairs" Now, I know what great stuff it is on land, with workshop fans-but at sea?and me, a flab berguited, advertising land, ubbert

I jumped into my buggy and spent a day hopping from one boat yard to another, along the Connecticut Shore, Some of those guys calked so fast, my pencil broke down trying to keep up. But I remember most of what they said. It goes like this-Plastic Wood for refuling rotted cavities around loose boats, for repeating stem denti-for restuping plank edges and splintered ends, for covering counremank screws, for repairing checks in spars, for strengthening joints in body work. "And that goes for fresh-water boats, too," one skipper yelled.

The boss said, "Pine, but you left out a few dozen other user. Better tell Popular Science Resders we have a special, FREE book on Plastic Wood for Bosts, Lot of good dope that will save them money on repairs-and put their boats in sailing trim. And tell them Plastic Wood can be worked like woodscraped, planed and pointed. It's as easy to handle as purry-and it's economical,"

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Seatt

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Also send me FREE the to book on PLASTIC WOOD FUR BUATS.

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HUNTING WATER LIFE FOR YOUR MICROSCOPE

(Continued from page 17)

the layer just removed. Animal or vegetable? This is still a most question.

In water from the bottom of a standard pool, we find another interesting form of leastfeld desired. These are single-celled plants that we can see the protection may be a substantial are constant may on whom a man that are constant more on whom it is the proposition of enjoyment in itself.

mal matter for the cers of the cummon house fly (Diptera or two-winged class of the South of or the two-winged class of the South of or two-winged class of the South of or two-winged class of the South of the first of the decayed matter, and place them under the microscope equipped with a low-powered objective. No need for long waiting, for the house five us we all know is a fast breeder in two days the exest have hatched and the latvar set about feetile on the decayed mail to be a fast of the puparant of the fully developed to est come and the antaleur was respective, and ellew the confirm eleveloped of the confirm of the eleveloped of the confirm of the eleveloped of the confirmation was respectively.

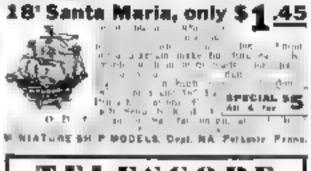
Further study of the ordinary house fly may be carried on profitably. We capture a big fellow, give him an alcohol bath, and proceed to distrember him with our operating equipment. A wine is pulled off with the Iweezen, placed on a stide, and examined Nature is a masterful aurplane designer as we shall note. A kee is clipped off at the body joint with the tiny thears or a raror blade It is supped between two glasses and placed on the sice Now we see how they so easily climb the wa and walk on the clause Pewer alignaform each font in add in to before a h which the fly grooms itself. We cut out an eye place it on a glass and sky a high-powered obfective (300 diameters) into place. We notice the eye is covered with dots resembling hones comb construction. Each dot is an eye in strell -a thousand eves in one

THE same process is carried out with the mosquito, starting with the last ac. A large colony of these pests may be started by merely placing a bucket of stale water, taken from a mud puridle, in a sunny spot in the back yard If we replace the water as it evaporates, we shall notice in a short time, little objects moving about by floping their tails. They are small but may be seen with the naked eye. Some of them are scooped into a glass and placed in a water rell. Only a lower-powered objective is necessary to study these insects. The mesquito is not an aquenos animal. It has to breathe and while it lives in the water it cannot take its oxygen supply from it. The periodic trips of the larvae to the surface are noticed. Each smeet pokes its breathing apparatus through the water surface, sucks air, and drops back

Now we can understand how the Government experts kill countless billions of these pests every year. The objective of the microscope to set on a line with the surface of the water in the water cell By moving the cell, we may then sweep the whole line of the water surface. A sincle drop of beavy oil is placed on the surface of the water with a medicine dropper It immediately spreads out into a thin, lough film. Up come the larvae to breathe They push against the oil film. It is elastic and we see it give under the pressure but it does not break. Again and again the insect struggles to break through to the source of hie-giving oxygen, but the film holds and the larvae at last sink to the bottom of the vessel dead.

I verywhere there is work and fun for the amateur microscopist. The more serious students are strongly advised to read one or more elementary books on hology and hotany









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RIGGING OUR NEW GALLEON MODEL

(Continued from page 66)



The Revenge is ly eighted. Note that the yards are a lightly braced up as if for a wind on the querier

and through that putting a small escutcheon pin, so that the deadeyes will all be light nown on the channels and the na is on one level. Note on the rigging plan, published test month, that they are spaced to miss the morates of the guns.

Now, into one end of a piece of a cord. seize a dendeye. Pass the other end up through the top, around the masthead, and down the same way on the starboard side. Fasten an-

top and fastened to the lower shrouds, but as other deadeys to lie level. Wax a piece of a up the lanvants. A a mouthed shetch to show at a gance the standing r ggang Much bonaveniure topmasts depends on getting th s neat, uniform, and sight Continued on page 86,

cord, put a knot in the end, reeve it from inside out through the top deadeye, outside in through the lower, and so on. Do this for both and haul tightly together, tying the ends off and adding a spot of glue above the Inp deadeye. Do this on alternate sides until all are compiete. Where there is an unexennumber of shrouds, pass the first and one sale and down the other tiet them good and tight, balancng the stays, with the masts at the currect angle as shown

Bore a hole fore-and aft in the fore and main topmasts 14 in from the equared upper part Make the crossives ay and cap-ed as before, only smaller (A complete key to the identifying numbers used in the text was given in last month's article) Smaller crosstrees and cups can be made at the two aftermasts for the flagstaffs, and also at the topicallant por head

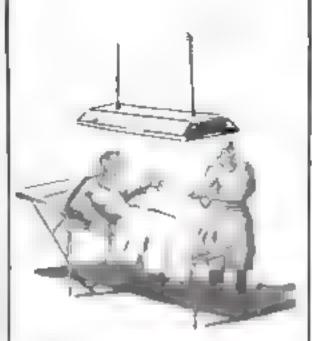
Reeve the fore and main topmast stays to and to of single size a bord, splicing or heatly secting an eye at the top. Hitch the forestay to the howspett end, and the main to the foremast just under the cap. The after topmast stays ju and ju can be of b cord hatched to a notch in the mainmast and

the nail in the mizzenmast

The topmast shrouds 13-30, three on a side, are of b cord. They are carried around the masthead as before and brought down to other deadeves in the tops. The lower deadeyes here are hitched to conf instead of wire The cord is passed through the holes in the

> they are awkward to reeve when in position, reeve them loosely first, bring them down close, and then tighten shrouds to a side will be enough at the missen and

From the fore and main



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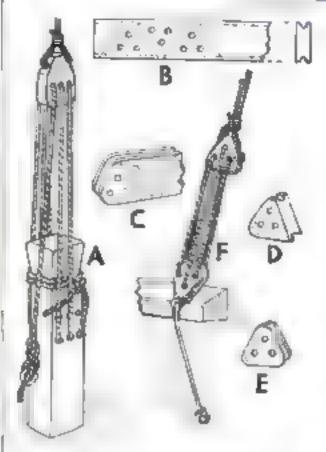
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RIGGING OUR NEW GALLEON MODEL

(Continued from page 85.



How deadeyes are made and used and method of reeving the main yard halyard to a knight

topmast-heads come also preventer backstays 37 and 36, which are bitched in the masthead One end comes down each side, with a ungle ta-in block in each end, then another block is used to the bolts in the channels and the

TWISTED

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LOOPS

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YARD

HALYARD

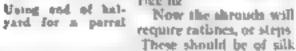
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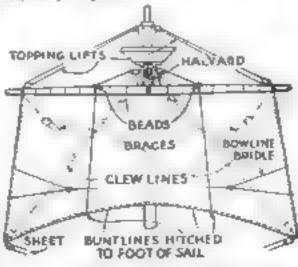
STAY

two brought tight with a fall (rope) of h cord.

The fore and main topgallant masts 39 and so are shipped through the topmust caps to the crosstrees, with stays at and so of b cord, fixed as for the topmast stays to the pow ions shown Two obrouds grand as each side will be needed, coming user potches in the ends of the crosstrees. They are hit hed or seized to the topmast Mar ha



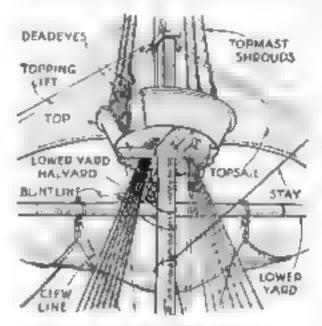
or sewing cotton about sue 60. They should be clove-hitched to each shroud. It is up to you if you want to shorten this work by hitching to the outside strouds and simply reeving around the others. A spacing of \$ 16 in is a bit wide for them, but looks about right. You can rathe down the topgaliant and mizzen and bonaventure topmast rigging or not, 45 you please



Pront of maintail before it is clewed up Note buntlines, clew lines, and bowline bridin

For the sails any thin labric will do. If they are to be belied, make them about 7 percent deeper A copper ware is run through the hero, with short ends extending at the top corners. These ends go through vertical holes in the

After the sails are bitched to the yards, the howline bridles are put on with beads. All the square sails should have clew lines and huntlines, but I put only clew lines on the courses and topsails, and buntlines on the manasail because I clewed that one up, without stiffening it. This gear is all of c cord. The elew lines have blocks fastened to the clew, or corner, of the sails themselves (unto



One of the most tops partly broken away to teres the deadeyes of the topmest chrouds

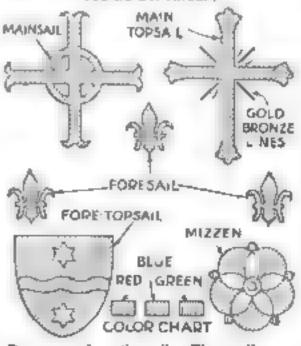
particularly that they are not instened to the yards) and another under he varies near the middle

The sail devices can be painted on one or both sides as shown below

The foresail and maintail have 1/4-in, sheet blocks, with & cord rove through

To set up the fore or main yard, take the red of the halyard, which was previously rove off to the knight as shown at A in the drawings at left above, pays it down on the fore aide. around the must, up around the yard and around the mast again as shown in the sma, drawing in the adjoining column, Finally, hitch the end to the first part and the standing part. This will serve as a parrel, Recve off the topping lifts with b cord from the yardarms to the blocks on the cap. Haul these tight to make the yard lie horizontal, and hitch to the kandrail

(TO BE CONTINUED,



Designs used on the sails. The small areas without trumbatching should be left white

Replacing Bolsters on Farm Trucks

Br L. M. ROFHI

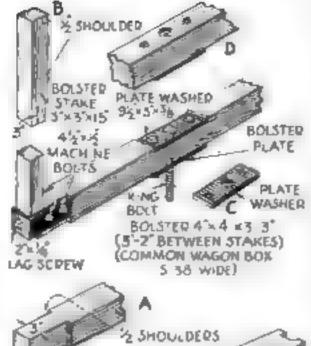
New York State Callege at Agriculture

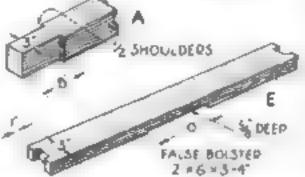
THE kingbolt of a low farm wagon often wears down into the bolster and weakens it, or the end of a bolster becomes damaged so that a replacement is necessary

A piece of tak, maple, or other hardwood 4 in, wide, 4 or 5 in thick, and 3 ft. 3 in long may be used. A piece 4 in, wide is preferable to a narrower piece. If the elevises are only 3 in and the bolster is wider it is rut as at A

If the boister stakes are broken, new ones are made as shown at B, with a 1/2-in shoulder at the lower end to rest on the bolster end. The stakes are held in place with 2 by 5/4 in

The holes in the bolster plate on the underside of the beister should be countersunk on the lower side. To prevent the head of the kingbult from wearing into the boister at the tup, one of three methods may be used. An from plate C, $9\frac{1}{2}$ by 3 by $\frac{1}{2}$ in., is made with holes of the same are and in the same position as those in the bolster plate. The plate is set deep enough into the bolster at the top so that the heads of the boits and singbolt will allow the wagon box to rest evenly on the boister. Two 5½ by ½ in machine bolts may be used to fasten the plate washer and bolster plate in place. The threaded ends of the bolts are cut off so as to leave projecting ends of 3/16 in. They are placed from the top, then the bolster is inverted so as to allow the built ends to rest on an anvil, and the bolt ends are riveted into the countersunk plate.





Now to make a new bolater and grevent the hingbalt from wearing it out too quickly

Another method is to make holes D in the holster at the top to allow the heads of the kingbolt and other bolts to drop in flush

If a false bobter E is used, the plate washer need not be set in, as the underside of the Jake bolter is cut out as shown

CIRCULAR SPOOL HOLDER SAVES SEWER'S TIME



THIS spool holder is admired by every woman who sees it—and rightly so, as a woman suggested the arrangement

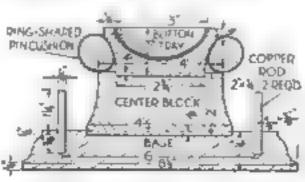
The wood I used was alder but walnut mahogany, or oak would be equally suitable if stained; and for an ename! finish any soft wood could be used. The dimensions were arrived at after careful study and should not be changed by more than a small amount

The button tray on top is first turned, then it is stained and polished while still in the lathe, using either wax alone or a shellar finish oil polished and with wax as a final enat. Next the tenter block is turned, and a depression 1/4 in, deep cut in the top so that the bottom of the button tray is an easy fit. This is not finished at this point. The base is now turned to say. Leave it on the face-

plate until all the following steps are completed. First, a depression \$6 in, deep is cut in the face to receive tabilly the bottom of the center block. Then the trede of holes is defiled for the spool peas, which are of \$4in, copper rod cut 2 in, long, but don't put them in until the very last thing. The holes are 1-64 in, under size so as to be a driving fit, and are \$\frac{1}{2}\$ in, deep, blake them all untform in depth. Now give the bottom of the centerpiece, put it in place, and run up the tail spindle of the lathe as a clamp. Wipe off the surplus give and let dry overnight

When thoroughly dry, stam and finish these parts in the lathe; then set the pincushion in place around the base of the botton cup, apply glue, and clamp by using the tall spindle as before. Let dry, remove from the faceplate, drive in the polished pers, and glue paper or cloth to the bottom

The pincushion is made of velvet in a harmonism color it really is a velvet doughout. Be sure to cut the cloth on the bias, then sew into a long roll, and stuff with wool Bend it into a circular shape to fit sough around the base of the button tray and sew the ends together. It need not be glued, if care is taken it will fit tight enough in the groove provided for holding it.—H. D. ALLEY



This sectional view shows how the parts of the spool holder are shaped and assembled

LISTEN!



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HIS TRAVELING STORE MET WITH SUCCESS



ILLIAM had worked for me as a stenographer for about three years. A year or so ago our husiness, along with a great many others, all but evapprated, and it was necessary to cut down on all fronts.

William had to go, we regretted it, for this (wenty-three year old lad was ambitions and intelligent—an unbentable combination. For some years, he had been studying the Spanish language very diligently. In fact, it was a specialized subject with him, as he was eventually aumine for a college professorship.

Just about the time William started hunting for a job that would not only support him, but also help pay for his studies, his brother returned bome from the Middle West, where he had been working in the retail grocery business.

Now he, too, was out of a job

The boys live in a well populated suburban town on Long Island, N. Y. Casting about for something to do, they fell back on their combined knowledge of the grocery business. Finally, they came out with an idea. They would start a traveling grocery store. It sounded good, so they scouled around and found a large, second-hand automobile truck, which they bought on a time payment basis. They set to work and fitted the sides with bandsome panels, proclaiming the nature of their business. Inside, the truck was fitted with all sorts of bins and shelves. The next step was to turn the large, clean and dry basement of their home into a stockroom and thus eliminate any rental overhead. Negotiations were opened with wholesalers, and a line of staple products secured at reasonable praces

WILLIAM had the looks, so he became the salesman. He got busy visiting homes in the nearby residential sections. His plan was to solicit orders by offering certain daily specials at extra low prices, and soon be had built up a sizable list of customers. The boys worked out a system of soliciting business in the mornings and making deliveries in the afternoons. William's brother handled the truck and did the buying

The idea caught and it became necessary to cover a larger sales area, so Wilham picked up a very cheap second-hand car for his route. Pretty soon orders started to come in by telephone. They were established! (Continued on page 89)

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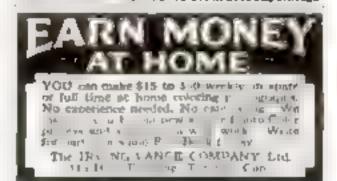
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MET WITH SUCCESS

Continue d from page 88 1

Of course, chain store competition has to be met, but a large item in their favor in keeping prices down has been the elimination of store rental and clerk hir. Now their business has grown to such proportions and covers so large a termocy, that they are senously considering the purchase of another truck.

This little business was not built up in s day. It took the perseverance and persistancy of youth and ambition to put n eventually on a sound basis. For William it has accomplished one thing supplied him with an income which will enable him to continue his studies. For although this idea has the possibilities of a large business. I don't think it wal satisfy William for long. He still has his eye on a profes orship in at least a small coslege -H M W New York N Y

STRANGE PLANT NURSERY A GROWING SUCCESS

YFATHER James Hard, Junfor, came to Florida twenty-three years ago. For reasons that have no place here, he had decided to leave the old Tennessee home and seek his fortune elsewhere. Florida



then a new and alluring land, beckuned strongly So Florida it was.

He settled down in the small town of Saint James City, which is on a tiny island on the Florida West Coast, some thirty miles from the mainland. In those days the surroundings were virtually primitive, and the life almost a pronecting one. For many years my father operated a small store, and found it an extremely difficult means of making a living. After all, there were only ninety-eight people on the end of the island where we lived'

In 1931 the store was on the vence of failure, and he decided it was time to make a new start. But there seemed little that could be done. It was too late now to begin again somewhere else, and the ittle island naturally had its limitations However he did bud some hing

Some years before there had been a rope factory on this island. They had devised a process of making rope out of the sisal plant and, for the purpose of extending their operations, this company had planted these sisal plants entensively all over the island

After a few (Continued on page 90)

Secrets of Success CHENISTRY

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Secrets of Success

STRANGE PLANT NURSERY A GROWING SUCCESS

(Continued from page 89)

years of midifferent fortune the company folded up and departed. Now-and this is years later-there are thousands of these sisal plants growing here. To the unaccustomed eye they present a strange sight. A spuny stalk supports the point and around the base are long, fleshy leaves, lying close to the ground, somewhat like an ornamental rosette in appearance. After about six years, the main stalk reaches a beight of fifteen or more feet. The leaves are colored varying shades of green, with white striping

Father's idea, of course, was to cultivate these plants for ornamental purposes He gathered a few plants of different colors and also several species of cactus and agave (very similar to aisql). These he planted in a small cultivated area. He was anxious about their growth, as they naturally grow wiid, in thick brush and

swampy places

The venture was successful. The plants thrived. Now he has over an acre cult vated. He has soid thousands of these plants to nurseries on the Farida mainland and has shipped them all over the world. Stial and agave have become quite popular for rock gardens. They seem tuthrive nicely in most temperate climates. The business has grown steadily and has become quite profitable. It is certainly better than trying to make a store pay on this little island, and the work is pleasant and healthy. All of which makes for success.-L.L.H., St. James City, Florida.

Cash Prizes

THIS department will give \$5.00 for every true success story submitted by readers of Popular Science Monthly, and which is accepted for printing in this magazine.

Manuscripts will be judged on the individual merits of the case and circumstances involved. Only stories in which the author's success, or that of some one known to the author, has been gained by some method of educational guidance, fitness for the job, or application to the work will be considered. We are not looking for the "get-richquick" type of story.

Manuscripts must be confined to 500 words or less. They must be true and, if accepted, authors must be prepared to give us signed statements to the effect that they are true. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless postage is provided for this purpose. Address con-tributions to Success Story Depart-ment, Popular Science Monthly, 381 4th Avenue, New York City.

HISTORY'S BIGGEST SHOW REVIEWS GREAT CENTURY

t " " d from page ;

fantastic specimens, Before this remarkable micro-vivarium display could be put into operation, a whole new method of mountaing the water drops, to prevent their evaporation under the intense light, and to keep the tiny creatures alive, had to be perfected.

Mirrors, in a nearby exhibit, reflect in a container of liquid an animated drawing or hudding yeast cells to demonstrate the process of fermentation. The cells, projected into the fluid instead of tipon a screen, appear to built and multiply within the container, each cell

enlarged to giant size

A twelve-foot cornstack, showing how plants make food from sunshine, a mechanical twig which puts on a year's growth of new cells in seventy-five seconds (PSM. Apr '33, p. 24); and a papier-matche cow that gives real milk (PSM., May '33, p. 33), turn other phases of scientific knowledge into lascibating exhibits of action. Much as Poweran Science Montitly pictures the drama of scient fic advance from month to month, the whole exposition presents the broad sweep of knowledge gained during a century of speciacionar progress.

COVERING one whole wall is an immense plant map of the world, divided into 500 sections. Each represents a special type of vegetation area. These areas light up in units m you can see at a glance the desert, forest, and barren-land sections of the world. The bage map is made of glass, aprayed with antime dyes and ighted from the rear. Oil pointings show in detail typical scenes in the different vegetation areas, ranging from the tropical jungle to the Arctic tundra, and picture the plants and animals common to each

Probably the most elaborate stagle exhibit of the exposition is the world's largest diorams, a ninety-font combination of models and paintings which tells the story of the gracing a transfer on and year of classic city. Rushing mountain streams spin the turbines of diminutive power stations, bushtension lines, built to scale, lead across the countryside to model towns and cities, where, on a twenty-four-hour cycle, the hundred and one uses of electric current are illustrated in minuture.

Revolving tubes of glass, lighted from within and having more different-colored sides, produce the lighting effects which run from numrise through the day to darkness. A complete cycle takes place every three minutes for five months, hearly a hundred men worked in a studio preparing this single

SIMILAR plastic pictures, on a less claborate scale, show Benjamin Frankan drawing electricity from the clouds, prehistoric monsters feeding amid the earliest forms of vegetation, natives cultivating pineapples and tapping rubber trees, and a miniature blast furnace converting raw ore into steel

Everywhere you find information dramatired, processes shown in action, facts and information revealed in thrilang exhibits. The exposition is an encyclopedia brought to life

A whole trange grove has been transported bodily from Florida, a redwood tree has come from California, and a twelve-foot waterfall, flanked by live birch, fir, and spruce trees from Michigan, reproduces in every detail a scene in the northern woods.

A glass automobile and a glass refrigerator enable you to see the mechanisms operating inside, and an infinite variety of products ranging from tooth paste to soft drinks take form and are buttled, canned, or placed in tubes while you watch. More than a score of large American corporations have taken

space at the exposition to show in action the processes by which their products are manufactured.

Overhead, the rocket ske cars of the milion-dollar Sky Ride, shoot between their 625-foot towers of steel. Amphibians shuttle back and forth, observation balloons hover in the air and passenger-carrying blumps cruise above Byrd's Anarctic ship, anchored in the faction, the gold-rooted Lama Temple of Jehol, brought from the Orient in 28,000 separate seems, and the Enchanted Island with its Magic Mountain are other wonders on display In this Land of Make-Believe, children find a coasier wagon tharty five feet long, a marble six feet in diameter, a Tin Woodman of Oztwenty feet tall, a fence made of wooden ciephants, and an enormous stator whose arms revolve with the wind.

IN THE great Pagenot of Transportation, you see depicted the dramatic advance from he ax cart and the Christoni to the modern automobile and the latest greybound of the sea, "The World a Million Years Ago" (P.S.M. June '52, p. 16) shows you monsters of the past in their natural surroundings. The architectural exhibits energy you from the rude log cabins of Fort Dearborn and Lancoln 5 the most modern dwellings - and benefit a projected House of the Future

Daring innovations in arch tecture form a striking feature of the buildings which house the exhibits. There are windowless walls, sky-hung roofs, metal atsuctures that expand and contract with heat and cold. Dramatic effects are achieved through illumination by cascading colored lights. By hight, the fairground becomes an immense manbow of glowing tubes and varicolored builts, surrounded by miles of "mot light fountains," billowing clouds of vapor filuminated in colors from within

In fact to take care of the water occils of the exposition, a water plant of 300,000,000 gallom capacity will operate twenty-four hours a day. Ten miles of water mains form an underground network and them are five miles of storm sewers to take case of emergencies. Facilities for a city of a million inhabitants are required for the visitors at the

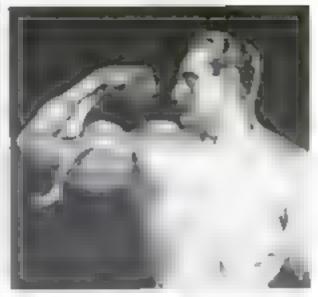
Century of Progress.

When the star ray which opened the exposition left Arcturus on its forty-year journey to the earth, the Chicago fair of 1893 was in process. Among the exhalts there was no automobile, no airplane no racio. The toal forty years of the 1833-1933 century, alone, cover practically the whole history of applied electricity, all of the wonders of the airplane, the movies, the radio, and other laborators miracles which have become part of everyday life. In invention and scientific discovery, the century just past was the most fertile of all houses.

It is the dramatized pageant of this advance which you see presented at the world's greatest spectacle now running at Chicago

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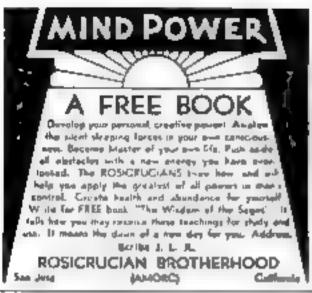
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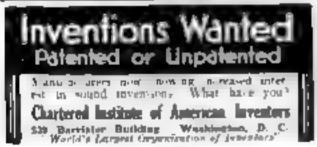






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WORLD'S FIRST STEAM-DRIVEN AIRPLANE

(Continued from page 11)

Superchargers, driving a blast of air into the carburetor to make up for the reduced pressure in carefied atmospheres, help these gasotme motors. They are heavy, however, adding to the weight of the plane, and they never completely prevent loss of power at high altitudes.

Now consider the steam entine. It loses no power at all with altitude and gazes in efficiency the logher it goes! This is because the pressure on the exhaust is less in thin air than at sea level. Thus the perfection of the flying team engine is a vital step toward conquering the stratosobere.

Realizant these facts, inventors in various parts of the world have been working toward the goal achieved by the Besler brothers. In thron, Ohio, last fall, a local inventor, Harold C. Johnson, announced the completion of a steam engine with two opposed cylinders, weighing, complete with boder, only 146 pounds

Some months earlier, it became known that the Great Lakes Aircraft Company, at Cleveland, Ohio, was working upon an experimental steam-driven biplane. Recent dispatches from france reported that a Paris mechanic had perfected a light steam power plant for airplanes. Another news from coming from Sweden, told of steam-turbine engineers who are working on a new-type turbine for aircraft (see, while a third, from Italy, carried the information that G. A. Raffaelli, an aeronautical engineer, had announced a steam engine for stratesphere machines.

But it was the two California inventors carrying on their secret researches, who first achieved the long-sought goal of steam-driven flight

Ever since Henri Giffard, in 1852, navigated the air in the world's first dirigible, creeping along near the outskirts of Paris at seven miles an hour propelled by a clumsy three-horsepower steam engine weighing 452 pounds, there have been proponents of steam power for airtraft.

Many of the pioneers of flight, before the perfection of the gas engine, sought to fly by steam. In 1894, Sir Hiram Maxim, the English inventor, spent \$700,000 building a gigantic multiplane weighing 8,000 pounds and having a wing area of almost 4,000 square feet. Driven by a 363 horsepower steam engine and two righteen-foot propellers, the giant craft reached thirty-six miles an hour on special tracks built to hold it down during the preliminary tests. Its lift at this speed was so great that it fore loose from the tracks, crashed over on one side, and demolished itself.

Two years later, Samuel Pierpont Langley, secretary of Smithsonian Institution, Washington, D. C., saw his sixteen-foot model fly for half a tude above the Potemac Raver pro-

pelled by a ministare, seven-pound steam eneme, developing one and one-half horsepower. The full-steed tandem monoplane which Langley patterned after this model in 1901 and which was broken in launching, carried a gasoline motor instead of a steam power plant

After 1903 and the success of the Wright Brothers, steam power for aircraft was practically lost sight of, Gasoline engines made such rapid advance in lightness and reliability that they cause into universal use in aviation. Recently, however, the advantages of steam power have again been attracting an increasing amount of attention.

With the first experimental machine already climbing into the air at Oakland, steam has, at last, been harnessed to work in the sky. Experts are watching the progress of the inventors with the krenest interest. Their machine is a definite step toward the huge, wanged steamers of the sky visioned by pioneers of flight.

AUTO GLASS THAT'S CRASH-PROOF

Continued from succ so,

"What's the secret of the stuff?" inquared Kennedy as he examined the cracked surface of the sale glass

"It's no secret," replied Gus, "Safe glass is made of two polished pieces of plate guss comented to a center sheet of transparent plastic material like celluloid. This center sheet is touch yet pliable and holds the outer and inner glass in place when it cracks

I hts black edging." Gus continued, "is a waterproof cement that scale over the edge of the plastic filler. After the two sheets of plate glass and the center sheet are bonded together under pressure and heat, the sheet of salety glass is disped in acid. The acid ents away the plastic filler and forms a shadow groove around the sheet When cement is forced in this groove, the plastic tenter is scaled in airtight. Mosture and air can't get at it."

Jue Chick, standing in the gazage doorway, fistened intently as his partner explained the process. "Do you know how they discovered the stuff?" he called when Gus had finished.

"About thirty years ago some French scientist was using a sort of liquid celluloid in his work. One day he forgot to tork the bottle. Of course, the liquid evaporated and left a thin layer of celluloid, or something like it, on the inside of the class bottle. He put the bottle aside and forgot about it until one day he accidentally knocked it from the shelf. It crashed to the ground, but instead of smashing to bits, it shattered, holding its shape. The hardened liquid held the tracked bits of glass in place. That gave him an idea and shortly after shatterproof glass.

was developed "

But doesn't all glass of that kind get discoursed after a time 6" Kennedy included Nope," Gais told him. The seal I just

Nope," Gas tote him The seal I just told you about stops discoloration to a great extent and a new type of transparent filer sheet has been developed that's not affected by the sun's rays. Good shatter-proof glass will stay clear as long as it's intact."

I don't doubt that safe glass is a wonderful thing " Kenneny agreen, but it costs a lot of dough

Gus shook his head flut it's an investment, a safety investment," he pointed out. "Fifty percent of all the injuries in automobile accidents come from flying glass, Twenty or thirty bucks isn't much to spend to make your cas fifty percent safet to ride in, is it? One good smash-up, when you have a car full of people, wilt cost you a lot more than that in doctor's bills alone

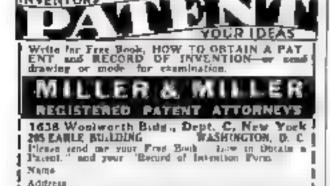
You RE paying a doctor right now and accidents like yours can happen any time Generally it won't be your fault, either

I guess you to right " said Kennedy after a pause "Suppose you fix my car up with it. With children in the family, safety means something."

"Just the windshield?" Gus asked glancing at Kennedy

Not on your life?" Kennedy replied. "If I do it at all, I'll do it right, Put in safe plans all round."

"Fine!" said Gut at he wrote out the order "Safety isu't something to buy in parts. Put it in front, back and aides and driving a car will be less of a worry to you."



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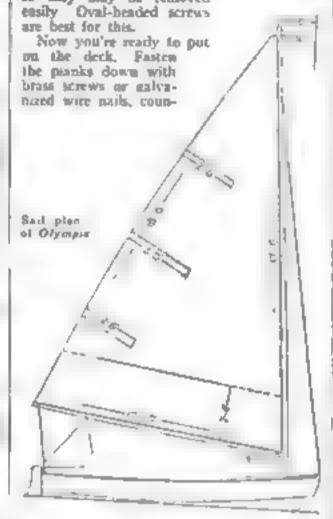
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HERE IS THE LAST WORD IN RACING CATBOATS

(Continued from page 50)

The frames should be bent in after the planking has been secured. You can hold them in place by stepping on them while shoring them in at the chine. Fasten the frames to the kees and planking from the outside with copper nails, riveted over copper hurs inside. Two to each plank will suffice

Following this, by the floor boards, preferably using % by 2½ in, sproce. Each board should be fastened with 1½-in, https://screws.so/they may be removed



Follow the deck with the coarning faster of it with screws to the carbing and deck. This should be installed in three pieces, butted at the end of the round and with a small butt block inside the coarning Oval-headed brais screws at 6-in intervals should be used.

By this time you will realize how quickly Olympic may be built, for you are now ready to lay the canvas. This should be the 8-or grade. Stretch it dry, then lay it in marine glue. Smear the glue on generously and let the convas, after being smoothed, drop 1% in, over the side. Tack it down with 14-in, copper tacks. After turning up the edge, secure the canvas with a %-in, quarter-round oak strip

Except for rudder, sail, mast and boom, Olympic is complete. No instructions for making the rudder, sail, and boom are needed, other than to cut the rudder from a single piece of mahogany according to the drawings. Likewise, plane down the boum from a spruce pole to measure, finished, 10 ft. 10 m. long, 2 in in diameter at the center, and 1½ in, at the ends. The sail may be made from any material you select, preferably 0-oz, duck

While I recommend a single-piece mast, which will weigh only 8 lb more than the hollow mast used during the Olympic competition, you can build a hollow mast by grooving two sproce sections and joining them. For this puspose hand screws or clamps every 12 in would be necessary—an expense probably not justified for private use. Otherwise, plane down the mast to measure 20 ft. 9½ in, from the top to the square piece fitting into the step

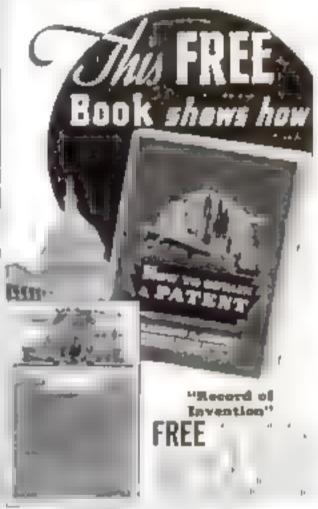
Should you be interested in building a hollow mast, details are shown and can easily be

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SEEING STARLAND WITH AN OPERA GLASS

Location from Juge gr

with lenses one and one half inches in diameter or larger. Use it to find the object and see its general features. Then exchange the opera glass for a field glass or eight or greater power to examine the details.

Above and a bitter to the maht of Antares, the opera glass will show you a wisp of light like a faint formless stay. This is a tubula a whole universe in the making.

SWEEP your glass along the Scorpson's body and up to the two stars at the cip of his tail. Just above, and to the left of these two stars, you will find two more star clusters. In the field glass, you can see their structure-each a closely packed ball of suns, many of them much larger than

Now sweep your glass from Scorpso's tail to the next group eastward, the Archer. In the upper part of the Archet, right on the pianet's race course, you will spot two parincularly fine star clusters, each composed of a multitude of little twinklers, none of which could be seen with the naked eye.

This whole region, where the Milky Way streams down across the ecliptic line, will repay a thorough searching with opera and held glass. You will discover many star groups and nebulae. Needless to say, this observing should be done on a clear, mooniess night The presence of a bright moon spotts every thing when you're looking for faint objects with a field glass.

While on the subject of nebular, we must mention the two grandest of all, although you must wait until next autumn and winter

before you can observe them

The first is in the constellation of Andromeda. The little map, inset in one of the illustrations accompanying this article, shows how to find it next November by a line from the posestar through the W of Cassiopea.

The photograph of the nebula in Andremeria was made with a powerful telescope When seen without a glass the faintness of no edges does not reveal its real size. It is actually about seven moon-breadths long and more than three wide

The only other actula that compares with it is the Great Nebula in Orion. This also can be found with the naked eye. Look for it next winter as the second of the three stars in the Sword of Orion, which hangs directly southward from his famous belt

We have left until the last the object you might think would have been the first of all to attract our glass, the moon. It was the first of the beavenly bodies upon which Galileo turned his new telescope. He discovered that, instead of having a smooth, gianty surface, as everybody had supposed, the moon had high mountains and deep valleys. These are still the objects of unceasing study by the astronomers of today. Do not make the mestake of pointing your opera or field glass at the moon when it is full and round, or you will be disappointed. Choose rather a time when the disk is part dark and part light, and look along the line where dark and light join. This line is called the terminator It is at this sunrise line on the moon that its mountains and traters appear most

THE best way to observe the moon with an opera gives is to begut when our satellite is a crescent in the west after sunset, and look at it every few evenings as the terminator advances across the surface. If you become familiar with the various features of the moon's reography as they appear successively on this fine between dark and light you will see them at their best and learn them easth a few at a time. The

three little maps reproduced show a few of the moon's thousands of features that have received names. Its surface has been mapped and named even more thoroughly than has that of the earth

In choosing a glass, remember that most good field glasses bend in the middle. In other words, it is possible to adjust the distance between their eye lenses so that the field, as seen with both eyes, is circular Few opera glasses have this means of adjustment. and sometimes, when the distance between the lenses does not fit your eyes, the two belds overlap, or fail to coincide, in a way that is both annoying and tiring. Any glass that shows a colored ring around objects is unfit for use

IF YOU have an opera glass of which you do not know the magnifying power, you can determine it easily Simply focus the mass on a brick wall firty feet or to away Then look through one barrel with one eye, while you look at the wall with the other eve and fed by the leases. Then notice how many bricks, as seen by the naked eye, are required to equal in thickness one brick seen through the glass. This number is the inagitalying power

In the next article we shall present some interesting experiments using everyday materials to explain the sometimes erratic and parating movements of the planets and the moon along the rate course of the sky Among other things, these experiments show why planets sometimes seem to move backward in their paths and why Mercury and Venus are sometimes morning stars and

somet mes evening stam.

THE prize of \$10, aftered for the best photograph of star trails made according to the directions given by Mr. Johnson in his article for April, has been awarded to John P. Cunningham, Conneaut, Ohio

Ster trail photos, submitted by the following, have been jound worthy of honor-

able mention

William J Cakill, Wohnen, Mass.; I. G G. Cooper, Staten Island, N Y.; Jack Davies, Syracuse, N Y; Warren A. Donaldson, Pittsburgh, Pa , Norman Green, Hamilton, Ontario, Canada, Walter R. Habbs, Je., Columbus, Ohio; Russell Laltola, frontond Mich., Philip B. Mansfield, Buffale, N. Y., Lucile Parsons, Scronton, Pa Walter Schroeder, Omaha, Nebr.; W. Edward White, Plymouth, N. II.

ROBOTS THAT ANSWER PHONE RENTED OUT

Rosors that answer the 'phone are now rented out to subscribers in Vienna, Austria. When the subscriber has to leave his home or office for any length of time, be sets the apparatus to indicate the hour at which he will return. All calls are automatically taken by the device which indicates by strokes of a gong when the owner of the telephone will be back and can be reached by the calling party. In addition, the apparatus keeps a record of all the calls received.

SAWDUST CLEANS FURS

CLEANING furs with sawdust is an innovation tried out with success by furriers in New Zealand. They report that white pine sawdust is a valuable aid in dressing and cleaning furs, American fur-cleaning establishments are now testing the unusual idea.

OIL FIELDS FOUND BY MODERN MARVELS

(Continued from page 31)

cement has been set, where the fluid level is, and possibly, if there are any oil sands that in other days were overlooked.

This strange electrical stethoscope is but one of many scientific eyes that enable oil men to peer through two miles of rock. Other interesting devices include electrical cameras that make photographs of the interior of the hole, picturing the structure of formations; and instruments that release an electrical current into a stratum, pick it up again, and measure its strength as it flows back through the earth, thus analyzing the nature of the formation.

AIRPLANES, too, now aid the geologist.

In the region of the Gulf of Mexico, occur many salt domes, where oil is held in a sort of great inverted tub, containing also a pool of salt water and a core of solid salt. Geologists frequently take to the air, studying not only the topography, but the color and appearance of the verdue.

color and appearance of the verdue.

A mottled color may mean that has is escaping from myriads of infinitesimal leaks in a gas and oil formation, bleaching the soil and changing the appearance of the shrubbery. Sometimes, from the air, may be seen a large circular pattern in the undergrowth, shading off so gradually as to be invisible from the ground, yet from the air yielding a plain ciue to hioden oil.

In probing for the salt dome, the temperature bomb is a new aid. It consists of a series of fusible alloy plugs, each with a different melting point. The lowest one is the scale, remaining unchanged in the well, represents the highest temperature below ground. Since it is usually bottest just above the salt plug, records of temperature gradients are useful

Another help is the torsion balance—a pair of spring balances, so sensitive that they measure differences in the earth's attraction as slight as one part in a million. When it passes over a place where a heavy formation approaches the surface, a change is registered by the instrument, betraying a hidden dome.

Will radium prove a telltale clue to oil? One Texas geologist recommends testing cores from wildest wells for radioactivity. Since oil has a strong absorbing power for radium emanations, be suggests that strong radioactivity may indicate the presence of hearby oil sones.

Sensitive chemical tests now detect the presence of good oil sands in cores that once would have been regarded as barren. If the oil sone contains heavy oil, the cores are dark brown or black, have a distinctive odor, and will staln the hands when handled. In some sands, oil can be detected by dissolving a little of the core in other, chloroform, or carbon tetrachloride, which will turn yellow or brown if oil is present.

IN SOME of the richest fields, including the famous Kettleman Hills where the oil is almost pure gasoline and will run an automobile without refining, the cores are light gray in color, and have only a faint gasoline odor. Such cores are treated with acctone, which, if oil be present, turns slightly cloudy.

For years the prominent hills forming Gato Ridge, in California, tempted geologists. It was in a country surrounded by oil fields. Half a century ago, miners worked in the tar outcroppings, mining oil with pick and shovel. As the years passed, nine wildcat wells were drilled, each one a little deeper, as drilling science advanced, but all were abandoned as dry holes.

Recently, geologists made a further study of the region. A well was started, and from the time the drill began to hite through the grass roots, a core-hit was in place. Geologists smiffed the cores, sto feet them through microscopes, made test solutions in acetone.

Down to 6,200 feet went the bit. Then geologists ordered the well plugged back to 2,250 feet, and a production test was made. Oil flowed forth—1,000 barrels a day. Strangely, everyone of the wells drilled in past years had passed right through the producing formation. Unaided by modern themstry, the drillers had not recognized the fortune within their grasp,

Oil from great pools under the ocean floor is an affering possibility now under study by peologists. Near Ventura, Calif., a structure that was already producing was discovered to show a trend toward the ocean. Did the choicest port of the field life submerged beneath the sea?

To answer this question, peologists hired a tup to take them along the bay. Surveyors on the shore sighted each position of the tup through transits, triangulating its location and recording it upon a map. Clad in diver's suits, peologists trod the ocean bottom, inspecting outcroppings of formations. A high-pressure jet cleared away the surface sand, removing about a hundred square

WITH him, each peologist carried a Brunton compass, consisting of a magnetic compass and set of spirit levels, and filled with water to prevent bubbles. Placing the back of the compass against the tilted formations, they read the dip of each bed by the levels, just as if they were on dry land. Recording their observations and checking them with aerial photos, they discovered that the formation actually extended seaward.

feet at each location and exposing bedrock.

A long pier was built out from the shore and a well drilled, striking a good producting formation. But prologists were not satisfied. Eager to test the structure further at sea, where their observations indicate the best production will be obtained, they are now building an island of steel, founded on piling driven into the ocean floor. A pipeline will carry the old ashore. Preliminary showings indicate that their deductions, based on this strange submarine geological work, are correct.

While making their deep-sea studies, geologists noted that the kelp heds seemed to follow the formations, being rooted in the sandy portions of the sea-bottom. From this fact, they hope in the future to be able to judge nil possibilities by study of serial photos showing the distribution of kelp fields.

WIRE NETTING GUARDS TELEPHONE LINES

A wine-nerving birdcage, an eighth of a mile long and twenty-four feet wide, now protects telephone lines running near the Columbia River, in Oregon, from flying rock. Long-distance wires were being sheared off by rocks blasted from a nearby quarry. The wire enclosure protects the lines and prevents interruption of the service.

RARE BEETLE IS FOUND IN TENNESSEE CAVE

Ove of the rarest beetles in the world is reported to have been found in a cave near Chattanooga, Tenn. It is said to be the first female of the species ever brought to light, the only other specimens known to have been found being two makes which were taken from the Egyptian tomb of King Tut-ankh-amen,



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Tricks of Firebugs Exposed by Police Experts

Continued from page 201

some cases, they admitted taking gasoline from the fire engine to start fires. Frequently, they said, the motor of the engine would be running and the firemen would be in their places waiting for the alarm when it came in t

Fitt, one of the ace firebug fighters of the country, trapped one gang recently which had left a million-dollar trail of incondiary fires from Toronto, Can., to Long Island, N. Y. Last year, he obtained convictions for more than forty firebogs, in one instance pinoing a \$10,000 crime to a man through observing that a knot in an unburned fuse had been

tied by a left-handed person.

Because an incendiary fire usually destroys the evidence of the crime, catching a torch wielder is one of the most difficult jobs a detective has to perform. The rules are combed for the minutest clues. How tany bits of evidence may put a sleuth on the trail of the criminal is illustrated in two recent examples.

IN A city in the Middle West, a man planned to hum his house for the insurance in a manner that would leave not the slightest clue behind. Near the foot of the cellar stairs, he placed a burning candle. At the top of the stairs, he filled a heavy cardboard hathon with gasoling. The box extended over the edge of the top step so, when the fluid softened the parteboard, the bottom would fall out on that side and the gasoline would rush down the stairs to be touched off by the flame of the candle. The time required for the pasteboard to soften gave him an opportunity to reach a place of safety.

The fire started as he had planned. But it.

ate its way so rapidly apward, it burned a bracing beam and permitted a wall to fall, burying the bottom steps before they burned. When the arson sleuth examined the cellar, he found the melted paration from the camile on a lower step. With this chance clue putting him on the trail, he traced the movements of the man and obtained his confession.

A few month ago, Sergeant Pitt turned over a brick in the basement of a home gutted by a suspicious fire. Under it, he saw the remains of a small pack of matches, the heads burned off and the stub of a gigarette wedged in among them. A fine line of ashes can to either side. The ashes represented a fuse that had

been strung through the matches before the rigarette was inserted among them. Then the rigarette had been lighted, burning slowly and giving the firebug time to escape before it touched off the matches which, in turn, lighted the fuse that carried the fire to tinder placed at strategic points about the house. The chance falling of a brick had preserved this evidence, exposing the plot.

MOST incendiary fixes are started by means of time devices that give the crook time to get away and establish an alibi by being somewhere else when the fire starts.

In one case, a handful of matches was fastened around a lighted cigar by means of a rubber band. When the tobacco burned down to the match-heads, the flame touched off a pile of papers sprinkled with rasoline, In another instance, a stick of chemical was placed at the bottom of a large tin can filled with water. A pin-hole in the bottom of the container permitted the water to drip gradually away. Two days later, when the last of the water had run from the can, the reaction between the oxygen in the air and the chemical caused the latter to burst into flame and ignite a jar of gasoline.

Candles, which burn at the rate of an inchan hour, are sometimes placed in huge boxes of excelsior so when the candle burns low, flame will reach the tinder at a cratain hour of the night. In several incendiary fires, a fuse was threaded through a hole near the bottom of a candle to carry the fire to piles of tinder when the candle burned down after

an clapse of several bours.

The most elaborate set-up of this bind was prepared by an eastern arebug. A quickmatch fuse, the fastest burning kind, was inserted in a capille and then run from one to another of forty-two wazed-paper containers. Each held a quart of gasoline. This string of containers extended through every room from the cellar to the garret. In addition, the owner pried up floorboards and stuffed gasoline-toaked rags beneath. He inserted a penknile between the laths in the wall and poured in gasoline. And, after the fire, a detective found that an overcoat, discovered beneath eighteen inches of water in the busement, still retained nearly half a pent of gusoline.

Just as the first container burst into flame, a neighbor drove into his yard. He had been delayed by tire trouble in returning from a late show. He saw the fire and telephoned in an alarm. In less than five minutes, the fire cagines were at the door pouring water into the interior of the dwelling. Under this deluge, the flames died out leaving a score of the containers intact. Through their mute testimony, the plotter was convicted and sentenced to prison.

Sometimes a detective, trailing firebugs, has to let them actually start a fire in order to obtain the evidence necessary to put them behind the bars. In such cases, all the preparations are made beforehand for split-second

work in extinguishing the flames,

A classic example is the manner in which Brophy wiped out an arrow ring in Brooklyn some years ago, To catch the firebugs redbanded, he let them start a fire in a building where nine innocent persons were sleeping. But, he had all his preparations ready. Chemical extinguishers and 300 feet of inch-anda-half fire hose were secreted in a peddler's wagon under its load of onions, potatoes, cabbage, string beans, and cauliflower, Street cleaners in the neighborhood were crack firefighters in disguise and other members of the fire department were hidden away in nearby

Brophy was watching a window on the upper floor where he know the gang was at work. There was a pull of smoke, A moment tater, two firebugs dashed out of the front door of the building, Brophy, with a right to the jaw, knocked one nut while a fireman nailed the other in a flying tackle.

VEGETABLES poured into the street as the hose and extinguishers were dragged from the wagon. A feverish few minutes followed. But when they were over, the blase was out, the residents of the house were safe, and the prisoners were on their way to just and, later, to fifteen years in Sing Sing.

The motives for arson, outside of the urge that drives on the unbalanced pyromaniae, I was told, are fraud, revenge, and an effort to cover up a murder or other crime by destroying the evidence. Fires for fraud far

outnumber the others.

Plant Growth and Yield Speeded in Midget Gardens

(Caelinved from page 25)

decreasing the aumber of hours of light a plant receives each day. Thus, radishes have been prevented from going to seed when spring gives way to summer, and have been kept in an edible condition for over a year. These light-effect studies may lead to profitable means of growing out-of-season fruits and vegetables-which is but another form of concentrated or accelerated gardening.

ALTHOUGH not gardening in a strict sense, a method of injecting new life into old orchards, described by the late Luther Burbank, makes it possible to save years of time in growing things for money, Burbank pointed out several cases where a fruit grower purchased an old, run-down orchard for almost nothing, and then cleaned it up by pruning trees, removing underbrush, cultivating the ground around the trees, adding fertilizer, growing clover or some other beneficial crop around trees for eventual plowing under, and finally by grafting new stock on old trees.

A method of hastening the ripening of fruit has been used by large growers and wholesalers for some time, and is rapidly gaining in popularity. This is the treating of nearlyripe fruit with ethylene gas. The process can

he adopted by the small-time gardener who desires early venetables and fruit, or who wishes to dispose of a portion of his crop at maximum profit. Cost of equipment for this ripening process is low.

The art of frust-ripening, now being revived, was developed by Chinese and Arabs centuries. ago. Not many years back, growers of oranges and other products were using kerosene lamps and lanterns to speed the ripening of fruit. Later it was found that the active agent in kerosene fumes was ethylene, a hydrocarbon that is found in illuminating gas. Today, bottled ethylene is used.

Gassed fruit is, in many cases, superior to tree-ripened products. It often has a better color, is sweeter, better flavored, and it can be produced more quickly. Green fruit can be shipped great distances without bruising, and then ripened to meet market requirements

at the point of consumption.

ETHYLENE gas is about as explosive as released into a room in such low concentration, one part to 1,000 of air, that there is little danger. The tank itself must be kept cool and not dropped, and no open fire can safely be placed near it. Usually the tank is taken into the ripening room just long enough to release the required amount of gas. Then it is removed. A few minutes later, after the gas has diffused through the room, an open dame will not cause an explosion. There is no affect on breathlast. The best fruit-ripening concentration of ethylene gas is one to 1,000, it takes a three percent concentration, or thirty times as much, to make an explosive mixture,

FRUITS and vegetables that have been rip-ened in large lots by the gas include tomatoes, bananas of all kinds, pineapples, celery, cantaloupes, limes, lemons, oranges, and grapefruit. Promising results have been obtained with pears, dates, jujubes, mangoes, peppers, alligator pears, pomegranates, apples, honeydew melons, passayas, plums, chayotes, custard apples, rhubarb, endive, chicory, and plantains.

Unfavorable results were obtained with asparagus, cauliflower, watermelons, and other products that have thick rinds and contain little hydrocarbonate reserves. Ethylene also has been suggested for fruits and vegetables from which tannins, chlorophyth, organic acids, and other bitter substances are to be removed. The gas can be used in converting starch in fruits into sugar.

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SHAMING MY BEARD'S

SO TOUGH THAT CLEAN

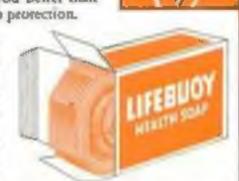
SHAWING RALSES WED WITH MY TENDER SKIN.

IT KEEPS ME DAINTY ON THE HOTTEST DAY

THE girl who takes pains to be always fresh and exquisite, is the girl who charms! The prettiest face can't excuse "B.O." (body oder). Bathe regularly with Lifebuoy. Its rich, purifying lather safeguards you against offending—desdorters pores—stops "B.O." Its clean, fresh, quickly-vanishing scent tells you better than words that Lifebuoy gives extra protection.



Every night, massage Lifebuoy shland, creamy lather well into the face; then runse. It depchanges pores of clogged impurious that dull the skin -clears and freshens complexions to new healthy radiance. A rapport of them protune to.



A REAL SHAVING TREAT





LIFEBUOY Staving Cream

WHY THE BEARD JOHN -

WORKING UP A DISGUISE?

The wetter the lather the better the shave

New lather holds 52% more moisture—gives clean. lasting, soothing shaves

Thy A Lifebuoy shave tomorrow morning—see what a difference this extra-moist lather makes. No more ordinary thin, quick-drying lathers for you! Lifebuoy shaving cream lather holds 52% more moisture. South whishers infl—extra infi. The razor mows them down clean—without bite or soing—for quick, close, 24-hour shaves. Lifebuoy soothes the skin—leaves it soft, suin-smooth and relaxed. Get the giant, cheerful ted tube at your druggist's today. Or write to Lever Bros. Co., Dept. A-147, Cambridge, Mass. for a free trial tube. (The offer good in U. S. and Canada only.)

TO BE POOLED

Live Dog from an Empty Kennel



HERE'S WHAT HE SAW

THE MAGICIAN ERECTED A KENNEL ON SMALL PLATFORM SHOW ING THE AUDI-ENCE EVERY SECTION OF THE DOG HOUSE AS HE INSTALLED IT. MAGICIAN WHISTLED AND OUT POPPED A DOG.



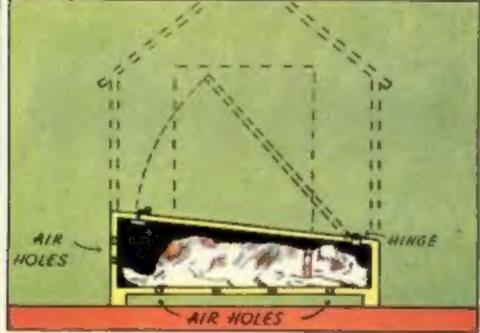


THE DOG WAS INSIDE THE PLATFORM

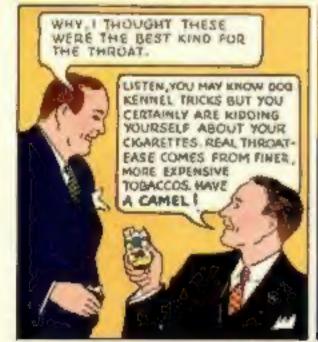
ALL THE TIME.

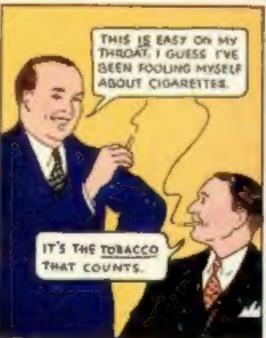
WHEN THE

RENNEL IS BUILT THE MAGICIAN PULLS & CATCH IN THE FLOOR. AND THE DOG SAME OUT.











TRICKS_JUST COSTLIER TOBACCOS